Published by:

Sponsored by:

DATA & MODELLING 2019

INCLUDES: MODELLING WORLD 2019 DELEGATE INFORMATION PACK

SYSTRA

WWW.SYSTRA.CO.UK

SYSTRA Ltd 50 years supporting the UK transportation sector

TRANSPORT MODELLING INNOVATION AND EXCELLENCE

Editorial offices
Apollo House
359 Kennington Lane
London SE11 5QY

Editor
Juliana O'Rourke
juliana.orourke@landor.co.uk

Managing Director
Rod Fletcher
rod.fletcher@landor.co.uk

Commercial Director
Daniel Simpson
daniel@landor.co.uk

Design / Production
Natalie Clarke
natalie@landor.co.uk

Printers
Solopress Ltd
9 Stock Road
Southend-on-Sea SS2 5QF

OPPORTUNITY IN UNCERTAIN TIMES

Our contributors to **Data & Modelling 2019**, and this year's cohort of speakers at **Modelling World**, all agree that as technological advances and evolving social trends intersect to drive a period of unprecedented change, data and modelling professionals must raise their game in order to take advantage of new opportunities.

Modellers and data professionals will play a key role in 'Deciding and Providing' for our mobility futures. As predatory tech and telecoms companies move in on the collection and distribution of data, the deep knowledge and experience of the modelling community should be invested in new tools to make the industry sustainable and, it has been suggested, research funds could come from private rather than public pockets. As many modellers have noted, Google doesn't care about TAG. The focus now should be on research rather than tweaking capital infrastructure business cases. Long-term modelling expertise is needed for new mobility solutions to work well for the benefit of society rather than scheme promoters..

At one recent conference, a frustrated modeller gave some good advice to the industry: get faster, demystify and communicate better, don't fix things that aren't broken, acknowledge limitations, be willing to fix mistakes and, importantly, broaden the resource pool. For the first time in many years, transport policy is both exciting to the media and top of policy agendas. Modellers should be proud to be working for the benefit of society, but change has to come in the form of more research, more cooperation and less consolidation, which limits both choice, competition and innovation.

All our 2019 speakers and contributors have something to say on the nature of change that is already happening, and how the modelling sector response needs to accelerate as the future becomes ever more uncertain.

I hope you enjoy Modelling World 2019.

Juliana O'Rourke, Editor

CONTENTS

SIMPLE CAN BE HARDER THAN COMPLEX

So said Steve Jobs, former Apple CEO, and he should know. Irrespective of the modelling approach or software used, the assumptions made when simplifying reality into a model are critical, says Tom van Vuren

Let's start with a platitude:'a model is a simplification of reality'. But how simple, and simplified in which way and for what reason? That's the job of the modeller to determine; and not just to determine but also to explain. TAG provides guidance, but the document is clear on the modeller's responsibility: "TAG provides advice aimed at ensuring that … the models used are appropriate to the type of scheme and its circumstances". Although in practice this is often interpreted in a way that increases both the scale and the complexity (better be sure!), well-thought through simplifications generally make the analyses both faster and more transparent. And that can only be a good thing, as long as we understand what the implied assumptions are behind the simplifications, and what the potential impacts are.

Over time I have become more and more interested in the assumptions behind and within our models, rather than the underpinning mathematical techniques and their implementation in software. Yes, end users need to be able to trust that we calculate what we promise: an equilibrium model needs to converge, and microsimulations must run through sufficient randomisations. But our responsibilities as modellers extend beyond the mechanics, and more so when the models are used in forecasting mode.

Here are a few examples why understanding the simplifications is essential, and explicit reporting of assumptions is important.

The future cost of using connected, autonomous vehicles: There is a growing literature base that forecasts the future role of connected autonomous vehicles (CAVs) within the transport system: one good summary paper is *'Effects of driverless vehicles – comparing simulations to get a broader picture'*, by Anna Pernestal and Ida Kristoffersson. Some model representations of using shared CAVs have assumed relatively high costs. The *'Automated and zero emissions vehicles infrastructure advice – transport modelling'* report by Infrastructure Victoria, Australia, assumes an AUS$2 flag fall plus additional costs of AUS$0.07 per min and AUS$0.22 per km.

The Infrastructure Victoria modelling runs also assume that travellers do not reflect, in their decision-making, the 'hidden' costs of car ownership, and only choose a mode based on the directly experienced costs of the trip itself. In other words, as soon as a person has access to a car, they only account for the variable costs when choosing that mode or not. So when a person gives up their car for some form of shared future mobility option that includes the fixed costs in the per minute or per km price, they will perceive the costs for use of that option as relatively high. Along the same lines, shared CAV use would be calculated to be higher under the premise of a subscription model, with higher up-front but fixed costs, and lower direct costs.

In comparison, the RethinkX report *'Rethinking Transportation 2020-2030'* estimates very low costs of US$0.10 - US$0.16 per mile for non-shared CAVs and US$0.03 - US$0.05 for shared (pooled) CAVs.

Not surprisingly, the calculated impacts on CAV mode share and total vehicle kilometrage can be very different: in the Infrastructure Victoria report the public transport share increases from 19% to 28%, the average distance walked goes up by 21% and there are only 0.4% additional vehicle kilometres in the network, compared to business as usual.

Other studies, for example by the MERGE consortium for Greenwich, report an expected increase in total kms driven between 20 and 55%. This is opposed to the Infrastructure Victoria findings that report an increase in public transport usage, the modal abstraction to CAVs in the MERGE study is mainly from bus (8-34%).

Now, I don't know which of the wide range of costs assumptions for shared CAVs is reasonable, but it's obvious that different values lead to very different answers. Without being up-front about my assumptions in that respect, I haven't done justice to my role and expertise as a modeller. And without explicit discussion of the impact of these assumptions, I probably haven't made the end user

We don't know which of the wide range of costs assumptions for shared CAVs is reasonable, but it's obvious that different values lead to very different answers

> Irrespective of the modelling approach or software used, the assumptions made when simplifying reality into a model are critical. I suggest we borrow the term Decide and Provide

sufficiently aware. The MERGE Greenwich report sets a good example by explaining that, according to their models, the price at which a CAV shared service is delivered is critical. An increase in minimum fares by £1 from £5 to £6 drops the demand by more than 20% – an elasticity of almost exactly 1. Similarly, they report that assumed parking charges for traditionally-owned cars affect demand for shared services strongly.

Assessing the value of pinchpoint removal interventions: A few weeks back, transport modelling and appraisal hit the headlines briefly following the release by Highways England of their report *'National Pinch Point Programme, One Year After Evaluation Meta-Analysis'*. Many commentators, including the BBC, reported that "England's traffic jams had got 'worse' despite congestion schemes". The reality was less dramatic and rooted in simplification gone wrong. What the actual report described was that the delay reductions, and hence the benefits that occurred during the busiest peak periods, were offset by disbenefits during the quieter off-peaks. The former had been the objective of the interventions, the latter an unintended consequence. Although the report isn't clear on this, I assume that this effect had not been picked up in the modelling and appraisal as the simplifying assumption had been made to only assess the busiest peaks, which must have seemed reasonable at the time.

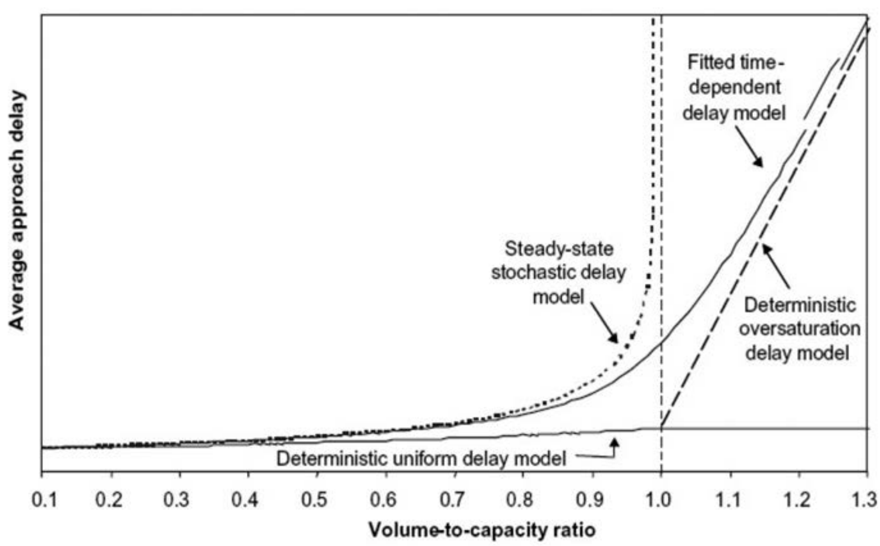
This is a good example in which, with hindsight, a sensible and proportional modelling simplification had a fundamental impact on the outcomes. In response, Highways England is changing its guidelines.

Delays at urban intersections: This is a bit more esoteric but nonetheless relevant. A recent discussion on *Linked In* raised the simplification of modelling intersections both in under- and over-saturated conditions. We tend to do this by using time dependent delay curves in models such as TRANSYT, SIDRA and SATURN. These simplified curves are derived through coordinate transformation between steady state queuing theory and time-dependent delay modelling (they were called shared delay curves when I was a SATURN modeller, see below).

The point that the originator of the *Linked In* discussion (Sajad Shiravi) made was, that despite this transformation being quite elegant and convenient, the greatest errors between the transformed curve and the original steady state and oversaturation delay curves is greatest between degrees of saturation between roughly 0.5 and 1.2, which is exactly the range of greatest interest for most applications. The simplification is not unreasonable, it enables efficient modelling, but do users understand the implications?

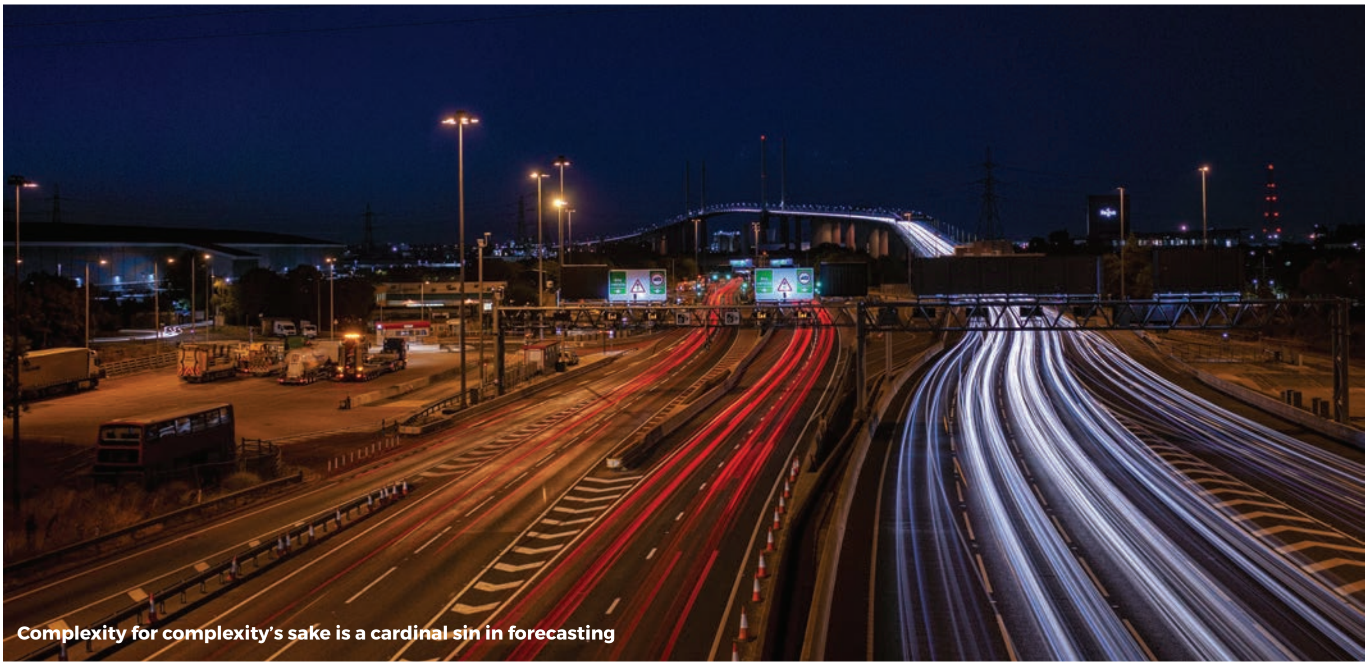
All three examples highlight that, irrespective of the modelling approach or software used, the assumptions made when simplifying reality into a model are critical.

I suggest we borrow the term 'Decide and Provide' from elsewhere in transport planning – decide which simplifications are reasonable and relevant, and provide both the rationale for using these simplifying assumptions and evidence of the impact on results. As my first example showed, the predicted mode shares of CAVs can be very, very different; whereas the second example illustrates that the implications of a straightforward and reasonable simplification can be substantial and surprising. As Steve Jobs said, simple can be harder than complex. ■



Source: Improving highway travel time estimation in FSUTMS by considering intersection delays, Feng Zhou and Zhen Ding

Tom van Vuren is Chairman of **Modelling World**. He is Mott MacDonald's Practice Leader Transport Planning for Australia, based in Sydney; and a Visiting Professor at the University of Leeds. **www.mottmac.com**


Complexity for complexity's sake is a cardinal sin in forecasting

CALL YOURSELF A FORECASTER?

Robert Bain examines how transport forecasting departs from modelling, and the implications for our profession. Better forecasting practice may not guarantee predictive accuracy, he concedes, but it would help to inform our understanding of what future states of the world could look like. Experience in this regard has been poor to date. Time to raise our game?

In business there is a common assumption that people who are good at their job can be promoted – effortlessly – into management positions; despite the fact that the attributes of good leaders (delegation, motivation, responsibility, feedback and so forth) may be far removed from the on-the-job skills garnered over the years. The result can be uncomfortable and unsatisfactory for all.

My experience from reviewing transportation projections for investors suggests that, unfortunately, the same is true for a number of demand forecasters. They've developed strong modelling skills over the years and can be relied upon to produce reasonably well-calibrated base-year models in most circumstances. This is their comfort zone; building on foundations put in place at university and/or on modelling courses, and fine-tuned through practical experience. Base-year modelling (simulation) is, for many, an enjoyable mathematical challenge with a satisfying end product. There's a right answer and goodness-of-fit statistics to demonstrate just how right you are.

Switch the model from simulation to forecasting mode, however, and comfort – and, my reviews suggest, interest – dissipates rapidly. Forecasting is way more difficult. It involves stepping out into the unknown with no roadmap to guide you. There is no 'right'. The modeller is no longer the go-to expert. Other people may have different views, and statistics alone can't prove them wrong. Evidence-based approaches compete with arguments of assertion allowing for objective-based or agenda-driven behaviour to contaminate, if not dominate, the forecasting process. Traditional teaching and academic texts focus on the mechanics of what to do (update your network, grow then re-assign your demand matrices) with little guidance – in the specific context of growth – about *how* to do it. This results in often poorly-estimated regression equations[i] employing a couple of explanatory variables from staggeringly short time-series being applied at the trip-end or matrix total level; albeit with some disaggregation (for example by vehicle class).

> “Good modellers don't necessarily make good forecasters

Compared to the science of base-year model calibration, the art of forecasting is horribly crude. Forecasting is the classic 'poor relation'; a rather frivolous pursuit somehow deemed less deserving of serious scientific attention. Just look at the reams of papers in academic journals and conference proceedings devoted to modelling alone. Yet the paradox is that much (if not most) applied transportation modelling is undertaken for the very purposes of forecasting!

Don't misunderstand me. I'm a strong advocate of straightforward, transparent modelling and rail against over-sophistication when circumstances simply don't support it. Complexity for complexity's sake, beloved of some, is a cardinal sin in forecasting, although some clients still get sucked-in by fancy mathematical footwork (*reassuringly difficult to comprehend!*). But surely there's some middle ground where a little more research, insight and intelligence should and could be applied to demand forecasting?

Many problems appear to stem from the fact that modellers often fail to *understand* what they're actually modelling[ii]: the product or service under investigation, its markets and their characteristics. Model development is highly quantitative with a strong, get-the-numbers-right emphasis. In other spheres, a mathematical preoccupation

Modellers often fail to understand what they're actually modelling

with getting – or forcing – a model to reflect 'observed' data is accompanied by warnings about over-fitting (and its potential to compromise predictive performance). Not so in applied transportation modelling. It's all about the goodness-of-fit of the model, an objective that can be achieved simply by bending the numbers into shape. Understanding, *per se*, needn't trouble the practitioner who has to calibrate a base-year model by the end of the week. Yet it is precisely this lack of understanding that shines so brightly when you turn to the forecasting write-up.

Stepping back, there seems to be three related factors in play:

1. Survey results (and other data sources) are commonly used as feedstock for the model, with more effort being focused on data manipulation and preparation than analysis and comprehension[iii].

2. Ninety per cent of the modelling effort is concentrated on getting the base-year model to accurately reflect today's observations. This involves tweaking the model and its parameters; a numbers exercise that can be completed in the absence of any particular empathy for, or understanding of, the data.

3. This leaves ten percent for the forecasts, which appear almost as an afterthought.

A recent review of a toll road traffic and revenue study illustrated the problem well. Construction of the toll road would significantly improve access to a major port from land-locked copper (and cobalt) mining areas. This, in turn, held the potential to shift the economics in favour of local extraction, impact on global competitiveness and move commodity prices. The forecasting story was all about copper, yet the traffic consultants made no effort to understand the demand for, or dynamics of, copper production. Late in the day a completely arbitrary growth rate of 3% per year was suggested for forecasting purpose. No support or justification provided. Demand forecasting at its worst!

Was the forecasting challenge difficult? For sure: but that's no reason to avoid it. Let's go back to basics. We're not in the business of pure mathematics. We're travel demand forecasters and on Day 1 we're taught that travel is a *derived* demand. So it's beholden upon us to understand the underlying factors at work. Sorry, modellers, it goes with the territory.

I occasionally come across serious efforts to understand travel markets. In the case of a toll road heavily dependent on trucks, road-freight experts were appointed to canvas the views of local truckers and industry representatives. This helped to understand behaviours, preferences and sensitivities; all of which were carried forward to the forecasts. Another effort surveyed cargo types in considerable detail to understand the investor's exposure to key commodity prices and flows, and assess concentration risk. And it's not uncommon for economics consultants to be retained separately to provide detailed input on the macro-variables at work and their likely trajectories. The key issue is that, done properly, modelling and forecasting are different tasks requiring different skillsets.

At its worst, the situation today results in technically-competent modelling professionals treating demand forecasting as an end-of-process inconvenience; the remaining and somewhat rushed to-do before the final invoice can be submitted. Wrong! Forecasting is all about understanding, and communicating that understanding to clients in ways that enable better-informed decisions to be made.

From the transportation studies I review on an almost weekly basis, it's very clear that good modellers don't necessarily make good forecasters. ■

Robert Bain runs RBconsult Ltd and is a Visiting Research Fellow at the University of Leeds. **www.robbain.com**

Notes:

i For more information see: Bain R (2018), *Beware Fake Econometrics,* Infrastructure Investor, Issue 96, 42-44, September 2018, PEI Media Ltd, London (available at: http://www.robbain.com/articlesandpapers.htm).

ii Equally, if not more, important is the fact that modellers often fail to understand what they're not modelling.

iii Related issues include a failure to properly critique the data (from various sources) being used to inform a model build.

We need to evolve our models to reflect a much larger cast of users with a more complex matrix of needs and priorities

RETHINKING TRANSPORT MODELLING

Cost and time: do these remain the fundamentals that define how we travel, and the trade-offs we make when we plan our journeys? By Duncan Irons

For decades in transport modelling the notions of cost and time have been axiomatic truths underlying just about everything we do. And yet, all around us, the traditional way of doing things is changing fast and our transport models should adapt accordingly. Models have responded in all sorts of ways to reflect new realities, but surely it is time to revisit those fundamentals, the very roots of what we do, and make sure we are still building on sound foundations?

The classical transport model conceptualises a journey as a sort of dead space between two life points; home and work, perhaps, or work and leisure. Of course, the traveller can do lots of things to make a journey a more positive experience – reading, listening to music, eating and so on – but traditionally the premise has been that travel time is a loss and it makes sense that quicker is better. And, all things being equal, the average person will pay to achieve that. But the interconnectedness of the digital world is challenging that idea. Mobile computing and wifi mean that travel time can be highly productive, if the conditions are right, especially for the increasingly large number of laptop warriors who are relaxed about flexible working and used to carrying their office with them. For travellers like these, the speed and price of the journey may be less of a priority than whether they can be guaranteed a table seat on the train, good wifi and a plug socket.

Equally, for many travellers, especially among younger generations, environmental issues are beginning to shove aside other considerations when choosing a mode of transport. These eco-minded cohorts seem to have abandoned the car and will choose to incorporate walking and cycling into their journeys even if it costs them considerable time, not just because they want to minimise emissions, but because of the value they place on the pleasure and positive impacts of a healthier lifestyle. And this, in itself, is an important re-thinking of urban travel and commuting. The question these young people are asking is why should such a major part of life be treated as a pill that has to be swallowed instead of something valuable to experience? As cities adapt to improve cycling and walking infrastructure, they reinforce such choices by making them more practical and pleasurable and set a virtuous circle rolling that leads away from more conventional travel patterns.

The availability of mobile apps that process data to co-ordinate this growing ecosystem of transport modes and to help travellers plan and connect their journeys is adding ever more complexity to the patterns of behaviour that we can observe in the real world. This is a phenomenon that is unlikely to slow down. More and more data are becoming available and developers are quick to grab it and give users faster, more responsive feedback and better planning tools. We can see a wide range of user types developing in response, from those who plan hardly at all, but rely on real-time live information to get them smoothly through their journey, to heavy-duty planners highly attuned to the benefits and incentives offered by

Many young people have become accustomed to a lifestyle in which private car use is less central than it has been for previous generations

providers for those who get in early.

And we have to assume we are only at the beginning of this huge social change. We are used to talking about Millennials as the apogee of the digital native, but already social scientists are talking about the next generation along: Generation Z. These are a new wave of consumers who have grown up in a digital world far more advanced and developed than any previous generation, and whose assumptions about how digital tech fits into and shapes their lives and work is bound to be altogether different than anything that has gone before.

The trend for young adults to drive less than previous generations began over 25 years ago. Today, young adults in the UK (and other countries) are driving far less now than young adults did in the early 1990s. The number of driving licenses issued to young people peaked in 1992 with 48% of 17-20 year-olds holding a driving licence and, by 2014, this had fallen to 29%.

Of course, there are many reasons: evidence indicates that the changes lie largely outside transport. Changes in travel behaviour have been driven by changes in young people's socio-economic situations; increased higher education participation, the rise of lower paid, less secure jobs and a decline in disposable income to name a few.

That said, many young people have become accustomed to a lifestyle in which private car use is less central than it has been for previous generations, and will likely remain so throughout their lives.

These days, convenience now plays a bigger part in travel behaviour choices for younger people, especially in large metropolitan areas where alternatives to driving are more readily available and where there are greater constraints on driving.

Are we confident that our current transport models can adequately take account of all these technical, social and demographic changes? I don't think we have any room for complacency. Most models do not even fully account for the arrival of Uber or similar services which, for many young urban travellers, is as natural a mode of transport as getting a bus was for their grandparents. And then there is the potential earthquake that is driverless cars, which seem always to be coming around the next corner.

So, what is to be done? As things stand, for any possible journey A to B, we model travellers who are essentially the same imagined person but with different priorities of cost and time. Like all models, it's a simplification and one that has proven to be reliable and effective. So far. But for the world we are entering, that is no longer going to be enough. We are going to have to evolve our models to reflect a much larger cast of users with a much more complex matrix of needs and priorities, or we are going to find that half of reality is lost to us. We need to think not just about where our traveller needs to get, when and for what price, but to ask what stage of life they are at?

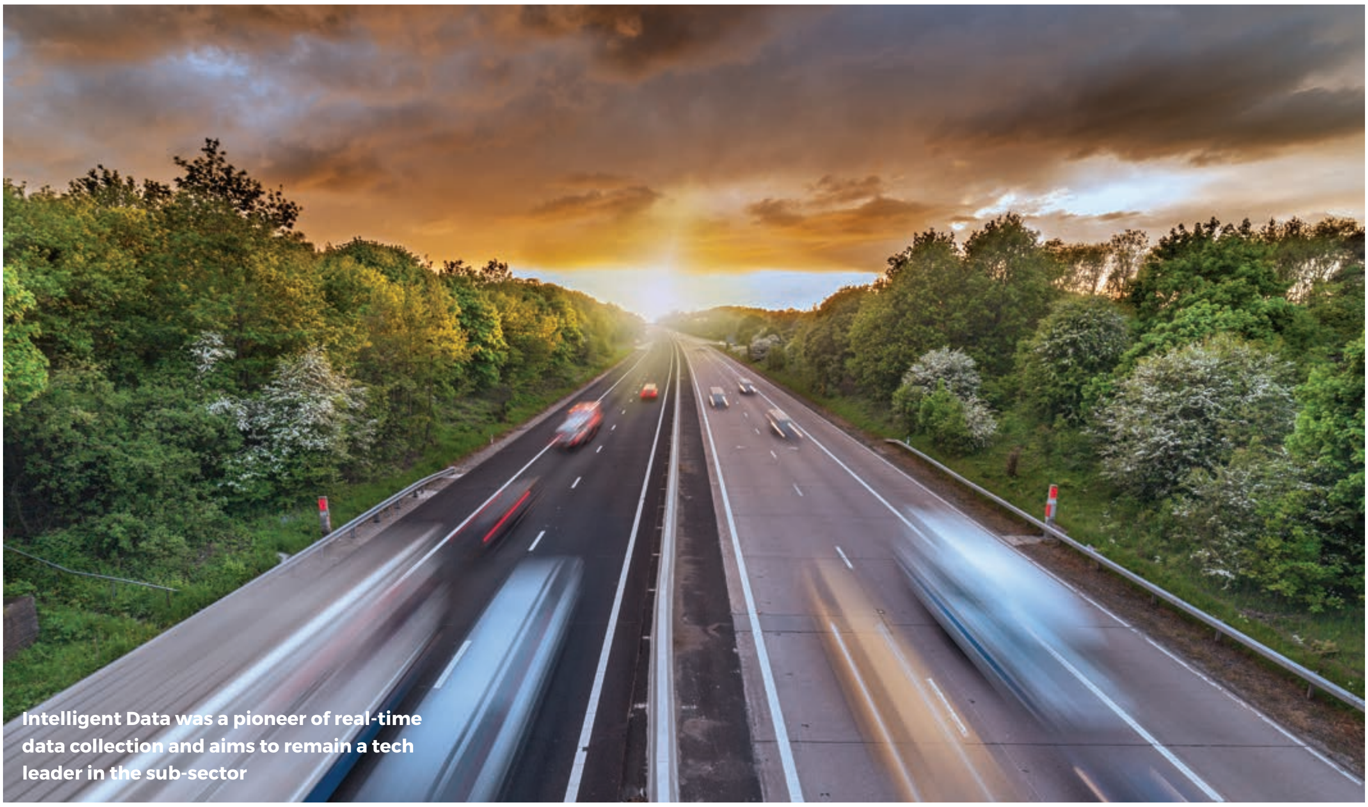
The younger generation is generally assumed to be more price sensitive than older travellers, for instance, yet also more environmentally aware, more fitness-focused, and digitally engaged. But older generations are not static. As the population ages we see older users using online tools to plan more and placing convenience and ease of travel above cost and time in their priorities. It may be that our traditional model of a rational choice between time and price may apply better to mid-career workers, perhaps with young children, who are time-poor and pressed for cash. But if we assume that these people represent everybody else in what is an ever more complex picture, we could be making a mistake that could have far-reaching consequences.

The advent of the railway nearly 200 years ago, and air travel 100 years ago, were quickly recognised as world-changing events, shortening what had until then been vast distances, allowing people to travel between locations at unimaginable speeds. But what wasn't instantly obvious was that these modes would not just change how people moved around in the world, they would change the world itself. Cities would change in size and shape and the nature of work and family life would be altered forever. What is true of trains and planes is true of all major new technologies. Our hand is shaped by the tool it holds. We are now experiencing the effects of a social change every bit as significant as those first trains and planes. Our modelling has to change just as profoundly. ■

Duncan Irons is Market Director, Modelling and Appraisal, SYSTRA
www.systra.co.uk

FUTURE DATA

In a time of rapid change in the transport sector, Paul O'Neill considers the opportunities for improving data collection, processing and compliance


Intelligent Data was a pioneer of real-time data collection and aims to remain a tech leader in the sub-sector

Things are changing fast in the transport sector. The rate of change we're seeing now is probably more rapid than I've experienced in my 20-plus years in the industry: lifestyles are changing with advances in digital technology, and Autonomous Vehicles and Mobility as a Service (MaaS) are likely to change the way that people move. So Intelligent Data is engaging more and more with new technologies to create solutions to ever more complex problems; recently we have added drones to the CCTV, ATC and ANPR equipment we already use.

Intelligent Data was a pioneer of real-time data collection and aims to remain a tech leader in the sub-sector. We were one of the first players to invest in and integrate equipment in a significant way, using Home Office-compliant cameras with a high level of accuracy; capturing more than 90 per cent of number plates, when other were using laborious manual processes. With major computing power and fast mobile networks coming on board, our core team will be able to collect and process much larger, more robust datasets than we ever have done.

I can see products coming online that will change the way that data is collected; using equipment that is not available to the market today. It might be sensor-based technology, it might be a hybrid technology using Artificial Intelligence.

> I founded Intelligent Data 12 years ago, when working as a modeller for a large consultancy, simply because the quality of data I was receiving, the practices employed to collect the data, and levels of service were really poor

We are, and will remain, at the forefront of investing heavily in technology to make sure we remain pioneers, either by developing products and software or by integrating existing services. Our mission will remain the same, to collect the highest quality data in the safest manner possible, backed up with excellent customer service.

Our clients will benefit from bigger and better datasets thanks to the investment we have made in our software systems. We've spent significant sums of money interfacing our products with the technologies that our customers are using.

So our real-time ANPR products, for example, interface with some of the leading software packages used in this sector. We have our own software development team creating products that not only improve quality, but also visualise and enable quicker access to datasets.

We've developed software around all the steps in the processes that our customers would normally follow. We collect data, and our software outputs it in a proprietary software format. So, for example, from a 10 million vehicle ANPR survey, we can visualise prior simulation model matrices in real time.

Timescales are also shrinking rapidly, thanks to technology. For example, a few years ago we collected a significant amount of data for a project – around 22 million ANPR records –which would normally have taken about six months to process. Yet we were able to speed up the time taken from data collection to data delivery significantly, delivering processed data in a couple of weeks. We are looking at supplying datasets that might be 100 times the size, and significantly more robust and more accurate, than those that modellers had access to even five years ago.

Data value

Data is valuable. I don't have any issues with open data, but there must be a level of quality assessment before it’s passed to third parties. I know that our data is very accurate because we subject it to rigorous QA processes, and that adds real value. There has to be a level of robustness in the data to make sure that it’s fit for purpose. I'm all for open data, and for sharing data, but it’s important to know that data suppliers are very different in terms of their QA processes. I know the quality and rigorous processes our data goes through before we pass it to the customer.

Open data such as that provided by Transport for London, for example, can be really, really powerful. I've seen an example recently using some rail data, looking at congestion points on the rail network; open data can be very useful in the identification of issues:

I was reading the other day that an Amazon executive was about to consign a product to history based on a gut feeling, but his team analysed the data supporting it, decided it was of value and launched it. A year later it added $2.3 billion to their revenue.

Data is there to support better decision-making, and we need to place a high value on this. It’s great to focus the mind at a kind of pre-feasibility level to look at where investment might be best placed. But in terms of the granularity of the data and digging into detail, even at pre-feasibility or feasibility stage, I’m not so sure that much open data can be used to that level of quality. I founded Intelligent Data 12 years ago, when working as a modeller for a large consultancy, simply because the quality of data I was receiving, the practices employed to collect the data, and levels of service were really poor.

A lot has changed in the sector in that time. The future is positive: the quality of data capture, processing and preparation is key to transport modelling, and new technologies are likely to improve all three functions in future. ■

Working with drones

There are major issues at a local level and on major arterial routes, and drones are proving to be very useful for clarifying the causes. With a queue of 3.5 kilometres long, it’s virtually impossible to use cameras to look along the length of the queue and see how drivers are behaving. So we deploy drones with 4k imagery capability and image stabilisation, for 12 hours or so, to film from 400 feet, and we can pick up an incredible amount of detail. Drone data really helps decision-makers understand what’s actually happening; in many cases, once they’ve looked at the data, they see that their hypotheses need refinement. Using a drone, we can actually see what is causing the issues. We have deployed drones at roundabouts, for example, to study supposed exit-blocking, but seen that exit blocking wasn't an issue at all, it was actually all related to signal timing. At this level of detail, drones offer real potential, at the pre-feasibility or feasibility stage of a study, to both supply great data for analysis and offer great value for money.

Paul O’Neill is Managing Director, Intelligent Data
www.intelligentdatacollection.com

BACKGROUND TO JOURNEY TIME STATISTICS: WHAT ARE THEY, WHY ARE THEY PRODUCED, AND HOW ARE THEY USED?

The Department for Transport's accessibility statistics are an essential input to key infrastructure decisions and provide required evidence for access to services for national and local government, transport planners, developers and small businesses. By Dan Saunders

The Department for Transport (DfT) has been developing and publishing information on the average journey time for over 10 years, giving a unique annual view of how accessibility in England has changed. These statistics present travel times from where people live to eight key local services including schools, hospitals, supermarkets and employment centres, broken down by small geographical areas in England. They cover journeys travelled by driving, cycling, walking and public transport.

These journey times are supplemented with connectivity reports to see how easy it is for someone to access an airport or railway station. Since 2015, the DfT has been using TRACC to produce these statistics itself, work which had previously been outsourced to a contractor.

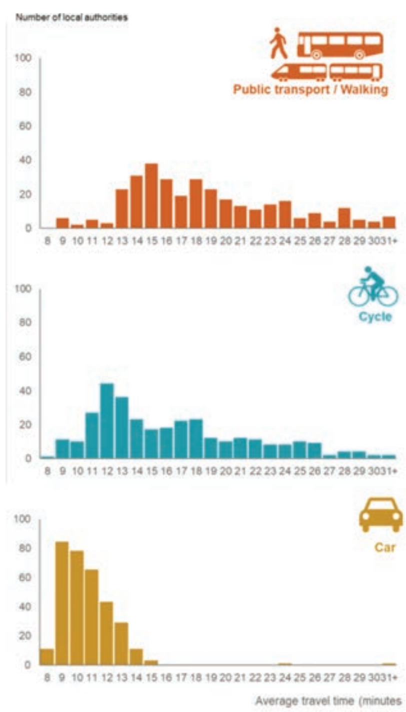
The DfT accessibility statistics are an essential input to key infrastructure decisions and provide required evidence for access to services for local government, transport planners, developers, small businesses and also for internal DfT transport modelling. When looking at new development sites, they help to deliver high-level insight into the provision of transport links to essential services such as the closest school.

The data covers the whole of England with an extensive scale of calculations looking at more than 170,000 origins. These are based on population and utilise census demographic centroids which cover, on average, 2,000 people per point.

The statistics then process this against around 82,000 destinations across a series of runs, with each run tailored to look at access on different days of the week and times of day. All of these variables result in millions of results that are then analysed. It's possible to get a detailed view of access in one year, and use this to analyse against previous years. For example, if you look at access to employment (100-499 jobs), in 2014 84% could access this type of destination within 15 minutes, while in 2016 this has fallen to 76%, highlighting either that the provision of public transport has become worse, or there are less small employment centres around, but either way it gives an indicative view that more investigation is needed.

How TRACC works

The journey time calculations are carried out using a commercially available software package called TRACC, owned by Basemap. TRACC is a desktop application that uses public transport and highways data to create journey times from origins to destinations. It uses timetable information showing both arrival and departure times at stops from public transport services against a specific time/day period. Highways information from road networks is used to fill the gaps between public transport services by creating a linear network that connects the origins, destinations and stops together. This provides a fully routable network of nodes and lines which is saved on file as a graph network. The graph network has various constraints which can be altered to suit the user need such as distance travelled, interchange delays on public transport and stopping limitations on road networks.



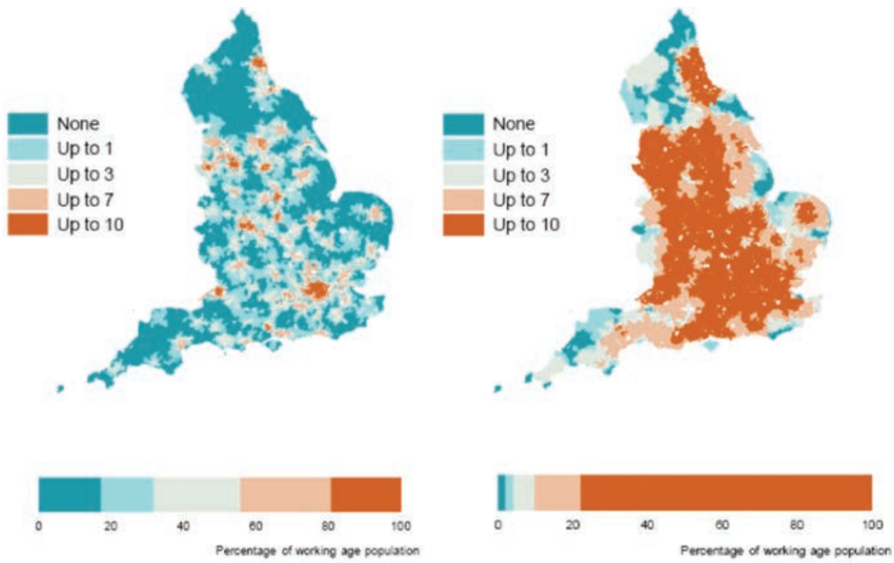
Travel time to reach nearest key services, local authority averages by transport mode, England 2015

The TRACC software then queries the graph network with origin and destination coordinates and uses the Dijkstra shortest path algorithm to route between these points. This is an algorithm for finding the shortest distance for travel between the graph networks.

For a public transport journey, the journey time produced includes all walking elements of the journey, for example the walk from the origin of the journey to the road, from the road to the public transport stops, any interchange of public transport using the road and then from the final stop to the destination via the road, and finally from the nearest point on the road network to the destination.

The journey assumes arrival at the first stop one minute before the initial departure, with any subsequent interchange waiting times included as part of the final journey time. Car, cycle or walk only journeys are similar except that, once the road network is reached, the journey proceeds link by link along the road network at speeds governed by data held in the model. These are specific to the mode, the road type, and in some cases the individual road link. The 10 shortest journey times from each origin (Output Area) are calculated for each destination type. For the public transport / walking mode, these consist of the 10 shortest journey times by either walking or public transport, after applying a 5-minute penalty for any journeys using public transport (to

> By having a consistent national view on transport accessibility, these journey time statistics have also been used to help aid policy decision-making at a local and government level, as well as for innovative future projects



Average number of large employment centres accessible within 45 minutes by public transport / walking

represent travellers arriving slightly early at the first stop).

Once they have the times, it is also possible to calculate the population that can reach a destination in a specific period of time; for example 30 mins or one hour. The statistics are published online making them accessible to all, including the general public which can use them to compare travel times between various locations and work out their individual times to local services. They have also proved particularly valuable in enabling local transport planners to monitor the average journey times to key services, by local authority. The data has provided a constant measurement by which each local government region can be evaluated and compared with other local councils in their area.

How these statistics have informed key transport projects

By having a consistent national view on transport accessibility, these journey time statistics have also been used to help aid policy decision-making at a local and government level, and for guiding innovative future projects. By using connectivity statistics as a baseline, it has been easy for the DfT to view journey times to key sites such as airports and train stations. These key hubs are essential for the promotion of economic growth and access to jobs and, with airports, to the world. By having these statistics, an underlying business case for the need for change can be created, and they have also provided essential intelligence for recent proposals, including the expansion of Heathrow Airport and the creation of the High Speed Two (HS2) railway linking London, Birmingham, the East Midlands, Leeds and Manchester.

Future use of travel time software

TRACC is already used far more regularly than in the annual statistics publication, and many other departments are showing an interest in this type of data, including the Department for Work and Pensions. As more statistics are produced and shared both internally and amongst other government departments, the need for this type of analysis has grown. TRACC allows the DfT to model routes and develop strategies and data comparisons over time, seeing how journey times and routes have changed. Recently they have been considering the possibility of connecting different datasets together, for example plugging in average speed data with accident data to see if there is any correlation between the two, and so gathering intelligence on which roads might be riskier than others. The DfT is also looking into how adding stops and services would impact journey times on existing routes, by modelling before and after snapshots. The ability to look at connectivity across major transport hubs and networks also means that it is possible for to assess route options to reach various employment centres looking at combinations of road, public transport and walking. This will help assess whether investment and development is possible in particular areas and what impact that would have on transportation in the area. ■

Dan joined Basemap in 2007 as its third employee and is known as 'Basemap Dan'. He is the fountain of all product knowledge and oversees the product range. **www.basemap.co.uk**

LOGICAL LOGISTICS

A huge amount of transport planning time goes into modelling future mobility, while separately logistics companies use planning tools to plan and optimise operations. If the two worked together, argues Devrim Kara, there would be significant benefits for all

Across the world transport planners design and optimise infrastructure by considering the way people and goods are transported. For example, planners use modelling to predict the effect HS2 might have on demand for roads; how many passengers may switch from cars to rail, or how many extra cars might be used to get people to and from stations?

Meanwhile in logistics, fleet operators use software that helps plan how to most efficiently use vehicles, drivers and depots. The process of transporting goods involves an extremely complex origin-destination network. However, fleet operators often don't take into consideration the capacity of the network, or how their operations impact on that capacity. Their aim is, understandably, to plan an operation which minimises their own cost by using the best parts of the road network.

Aligning objectives

So we have two very different, yet equally vital, parts of the transportation industry with different objectives: freight uses the infrastructure, while the transport planning industry does its best to manage performance, investment, capacity and operational needs.

The problem is they are disjointed. The planning process between the two is minimally, if at all, integrated. Transport planners don't tend to get information about where freight vehicles travel, what is their purpose and what they are delivering, plus where they are planning to deliver in the future. They are therefore unable to understand how the freight industry deploys vehicles on the network, nor its impacts.

Meanwhile, freight planners do not understand the depth to which

A collaborative pilot project

The A13 example is purely for illustration: A pilot project could take place on any stretch of Highways England's strategic road network

My idea requires the two industries to closely collaborate and I believe the best way of starting this is 'proof of concept' and pilot projects. Consider, for example, the development of an integrated transport and freight planning corridor. This is something that could form a blueprint for other strategic corridors and operators of the road network across the country.

Let's imagine a corridor along the A13 which goes from east London to the coast, past a major port, London Gateway, and also feeding into the A12 which is the main artery to Felixstowe and Harwich. Not surprisingly, there are many warehouses and distribution centres along this road.

At the moment the corridor is an A road, built to motorway standards in many stretches, and has mostly three lanes in each direction. It is therefore high capacity, relatively high speed with a high proportion of freight compared to other London roads. If there is an incident within London close to the A13, or on it, there is a huge impact on traffic in general and freight operations in particular.

What ought to happen in cases of congestion on the A13 is that the freight vehicles deviate completely from their original plans, but as it stands there isn't enough information they can use to help themselves. A corridor like this can be chosen to demonstrate how the planning process, both in terms of business as usual on the road and traffic, can be informed by a transportation model.

Freight planners can use a model to help them decide how they plan to route their vehicles, but also test different scenarios in response to incidents to help them design mitigation plans. This helps them understand the optimal way of diverting, especially at locations where incidents do take place on a more regular basis.

The transport model used by planners can be used to help freight managers create better optimised routes and strategies. It can help them plan their routing more effectively in the future. This will save time, fuel, and therefore costs.

In a collaborative approach like this, the freight operators and the authorities will need to agree on future plans that will help both sides deal with incidents in the most effective manner – a true win-win situation.

transport planners study the network and its mobility patterns. They may use real-time traffic information to plan their journeys, but tend not to know about future interventions such as roadworks or major events. Similarly, the freight industry has little influence over how the road network is planned: it develops depots, vehicle fleets and specifications based primarily on its strategic plans.

There are a huge number of freight vehicles on the roads, and Transport for London has observed a rapid increase in the number of light goods vans, largely due to the explosion in online shopping and changes in patterns of deliveries and fleet specifications. These additional trips have put pressure on the road network and increased congestion and emissions. Meanwhile new restrictions on freight transport, such as clean air and low emission zones, will have an effect that is yet to be understood.

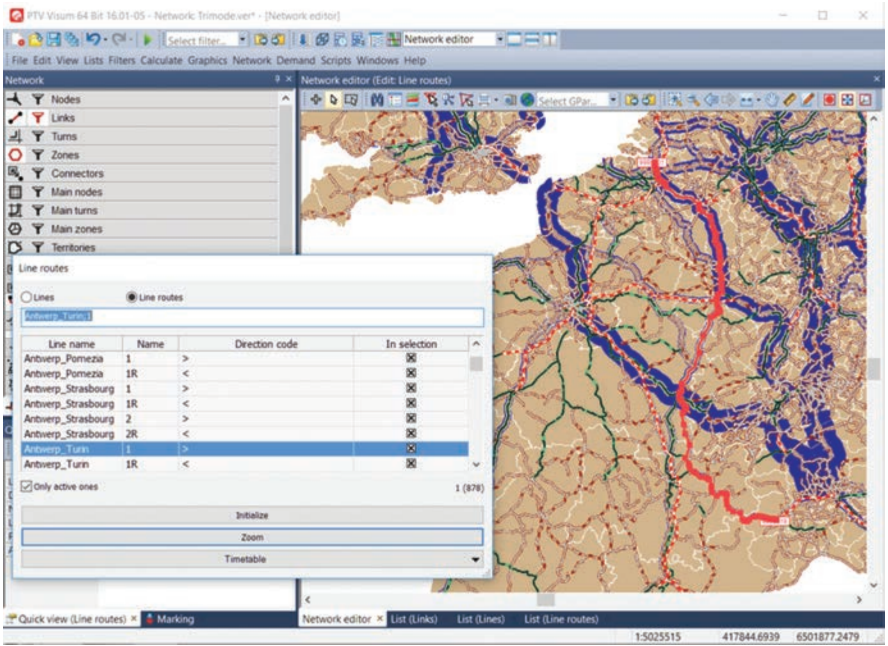
It is clear that professionals in the planning process and logistics deployment needs to improve cooperation. A significant proportion of both the transport planning and the logistics industry uses PTV software to plan and optimise the movement of people and goods, so we hope to drive some changes in this area.

There are always concerns that if the logistics industry shares data there will be an impact on competitive advantage or privacy; but these issues can be managed with technology. With integrated data and planning processes, all partners can increase the efficiency of the planning process and optimise the movement of people and goods.

Real-time decision support

But we can do more than just focus on the long-term; with computer processing power and traffic information quality improving hugely all the time, we can do this in real time too. We can link the current route a freight vehicle is taking with the authority's traffic control centre, so it can be aware of a freight vehicle's origin, destination and its planned route. In this way, in the event of an incident, the authority could have direct access to the driver to send information to help choose the best routes and divert in the most effective manner.

PTV Group already has a real-time predictive decision support model, using real-time data to predict what will happen on the network in the near future and implement changes, for example the phasing of traffic lights, to mitigate problems *before they occur*. Such technology could also integrate live freight data and use that to make predictions about the impact of incidents in real time, and better influence the users of the road network: an additional big win for a transport authority. With PTV's access to both the transport planning and freight industry, we have a unique opportunity to help achieve this collaboration. ■

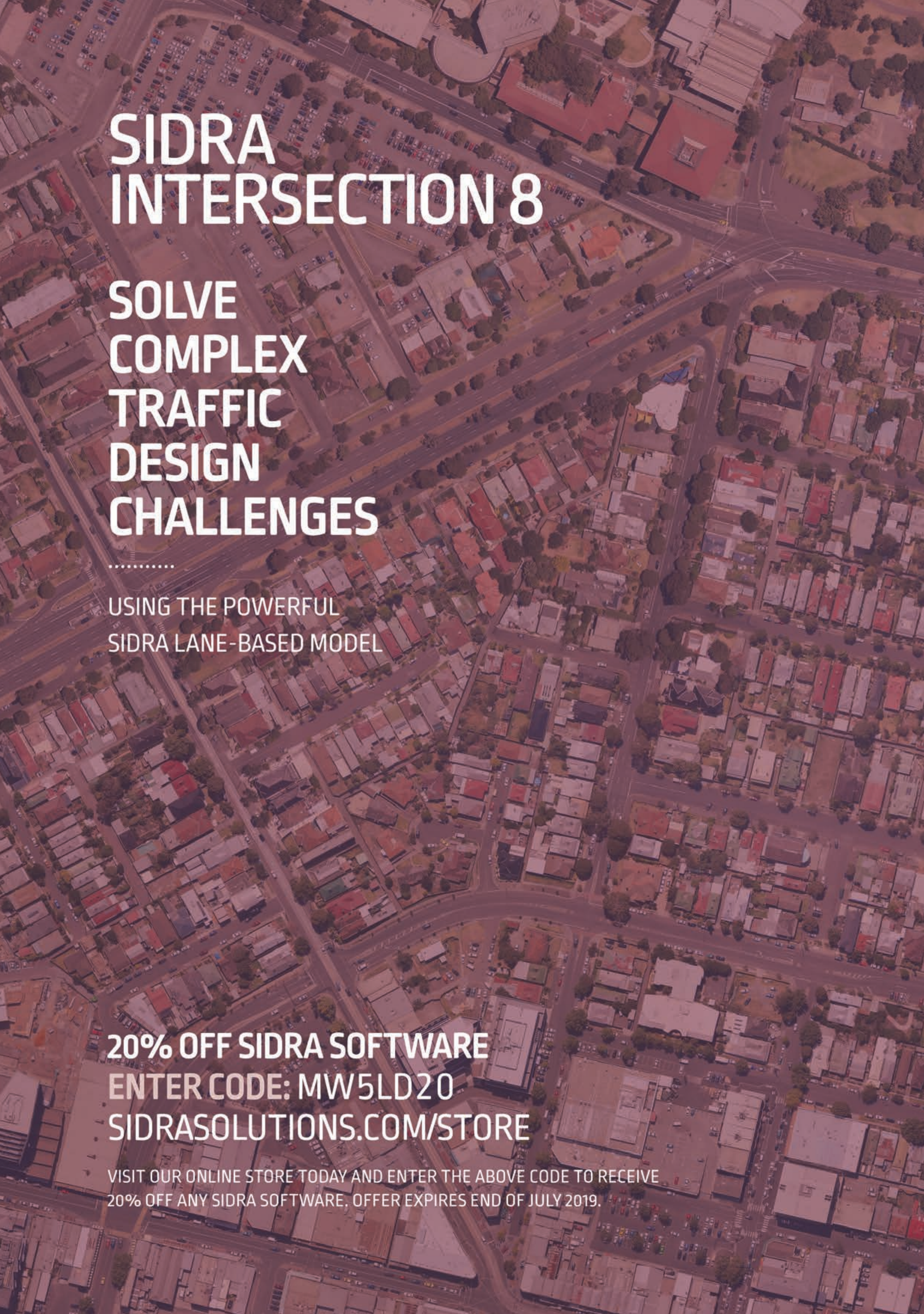


A significant proportion of both the transport planning and the logistics industry uses PTV software

London has seen a rapid increase in light goods vans

It is clear that professionals in transport planning and logistics deployment need to improve cooperation

Devrim Kara is Director at PTV UK
www.ptvgroup.com/en


SIDRA INTERSECTION 8
SOLVE COMPLEX TRAFFIC DESIGN CHALLENGES
USING THE POWERFUL SIDRA LANE-BASED MODEL
20% OFF SIDRA SOFTWARE
ENTER CODE: MW5LD20
SIDRASOLUTIONS.COM/STORE
VISIT OUR ONLINE STORE TODAY AND ENTER THE ABOVE CODE TO RECEIVE 20% OFF ANY SIDRA SOFTWARE. OFFER EXPIRES END OF JULY 2019.

Organised by:

landor LINKS

Sponsored by:

PTV GROUP the mind of movement

SYSTRA

intelligentdata

MODELLING WORLD 2019

4 - 5 JUNE EDGBASTON STADIUM BIRMINGHAM

DELEGATE INFORMATION PACK

Supported by:

aimsun.

Department for Transport

MOTT MACDONALD

TRANSPORT FOR THE NORTH

CATAPULT Connected Places

vectio

www.modellingworld2019.uk

TUESDAY 4 JUNE — DIGITAL TWINS WORKSHOP

14.00 Registration opens

14.30 **West Suite**

Session 1: Integrating city-scale data to improve planning and prediction

Convener: Mark Enzer, Chief Technical Officer, Mott MacDonald and Chair, Digital Framework Task Group (DFTG), Centre for Digital Built Britain

Digital twin technology will integrate data from different sources to enable effective data analytics and drive better decisions. An ecosystem of digital twins, of different infrastructure assets and systems, will enable a wide range of data sources to be more effectively input into modelling infrastructure

Stefan Webb, Director of Digitising Planning and Standards, Connected Places Catapult
Phil James, Director, National Urban Observatory Facility, Newcastle University
Lorraine Butler, Smart Motorways Delivery Director, Operations, Business Improvement and Change, Highways England

Followed by panel discussion and Q+A

16.00 Networking break

16.30 **West Suite**

Session 2: Pioneering digital twins

Understanding the impact of digital twins on clients, consultancies and the supply chain

Going digital in rail: smarter infrastructure from plan to operations
Eduardo Lazzarotto, Senior Business Development Manager, Design Engineering, Bentley Systems

Modelling urban energy systems using a digital twin: developing a toolkit for policy analysis
Aruna Sivakumar, Executive Director, Urban Systems Lab & Senior Lecturer, Centre for Transport Studies, Imperial College London

A 3D digital twin for asset, traffic and emergency management
Sonal Ahuja, Executive Director, Sunovatech

Towards digital twins for future mobility
Matthieu Francoz, Business Developer Worldwide, Dassault Systémes

18.00 **Seminar close** - networking tea & coffee served

TUESDAY 4 JUNE — NETWORKING DINNER

18.30 Registration opens, with seating for dinner beginning at 19.30

Pre-drinks dinner sponsored by: TMPlans, sunovatech passionate to imagine

19.30 **Warwickshire Suite**

Networking Dinner

Plus speech by: **Simon Statham**, Head of Technical Programme, Midlands Connect

21.30 **Drinks served at the bar** — Sponsored by: intelligentdata

WEDNESDAY 5 JUNE — PROGRAMME

08.45 **Delegate registration** in the foyer outside the Banqueting Suite with refreshments served inside the main exhibition hall area

09.30 West Suite

MORNING PLENARY

Innovative approaches to developing next generation models

Chair: Tom van Vuren, Divisional Director, Mott MacDonald

Llewelyn Morgan, Head of Innovation, Oxfordshire County Council

Richard Bradley, Head of Data, Modelling & Appraisal, Transport for the North

Mike Waters, Director of Policy, Strategy and Innovation, Transport for West Midlands

Tim Veitch, CEO, Veitch Lister Consulting

11.00 **Morning break:** Tea & coffee served in the main exhibition hall area

11.30

West Suite

DFT MODELLING AND APPRAISAL STRATEGIES: NEXT STEPS

Chair: Claire Worsdall, Head of Strategic Analysis, Department for Transport (DfT)

Outcomes from the appraisal and modelling strategies: priorities and next steps
Claire Worsdall, Head of Strategic Analysis, DfT and Helen Bowkett, Senior Technical Director, Arcadis

Demand matrix building: emerging guidance
Nila Sari, Principal Transport Modeller, DfT and Reza Tolouei, Associate Director, Aecom

Congested values of time
Iven Stead, Economist, DfT

NTM v5: a new model to enhance our forecasting capability
Philip Sumner, Principal Transport Modeller, DfT and Tim Gent, Technical Director, Atkins

The future of the National Trip End Model
Roger Witte, Principal Transport Modeller, DfT

Sponsored by: Department for Transport

1882 Lounge

INNOVATION IN DATA AND DATA HANDLING

Chair: Paul O'Neill, Director, Intelligent Data

Drone surveys: a new source of data for transport planners
Gavin Coupe, Managing Consultant, Atkins and Duncan Armstrong, Managing Director, Kestrel Cam

Using new evidential data to better understand the root causes of congestion
Dr Sam Chapman, Chief Innovation Officer, Co-Founder and Director, The Floow

Adding detail to anonymised data by merging traditional surveys and big data
Charisma Choudhury, Associate Professor, Institute for Transport Studies and School of Civil Engineering, University of Leeds

Optimisation study and mobility improvement for Gaborone's urban traffic system
Jude Freeman, Director, Vectio UK

Sponsored by: intelligentdata

Chairman's Lounge

FREIGHT MODELLING

Chair: Dave Carter, Transport Modelling Market Director, SYSTRA

The drivers of freight in London and their interactions
Collins Teye, Strategic Transport Modeller, Transport for London

Modelling freight in long-term investment programmes
Chris Wright, Technical Director, MDS Transmodal and Wei Cui, Principal Technical Management and Assurance Officer, Transport for the North

Integrated logistics and transport planning
Devrim Kara, Director, PTV Group UK & Ireland and James de Roo, Director, UK Logistics, PTV Group

Large-scale simulation for logistics services
Dave Williams, Solutions Director, Immense Simulations

Sponsored by: PTV GROUP the mind of movement

13.15 **Lunch:** Served in the main exhibition hall area

Sponsored by: PTV GROUP the mind of movement

PROGRAMME — WEDNESDAY 5 JUNE

14.30

West Suite

CURRENT AND NEW TOOLS: BALANCING INNOVATION WITH 'TRIED AND TESTED'

Chair: Tim Gent, Technical Director, Transportation, Atkins, UK & Europe

Using machine learning techniques in transport modelling
Tim Veitch, CEO, Veitch Lister Consulting

MoTiON: a new travel demand model for London
Claire Cheriyan, Strategic Analysis Manager, Transport for London & Elena Golovenko, Technical Director, Transport Modelling, Jacobs

A low cost national transport model
Adil Mohammad, Traffic and Pedestrian Modelling Consultant

Application and analysis of Google Maps Journey Time Data in transport planning: A proof of concept study
Siamak Khorgami, Regional Director, Consulting, Transportation, EMEA, Aecom

1882 Lounge

AGENT-BASED MODELS – INNOVATION OR DISTRACTION

Chair: Dr Patrizia Franco, Senior Technologist in Transport Modelling, Connected Places Catapult

Large scale agent-based simulation
Vittoria Parisi, Senior Applications Engineer, Immense Simulations

Modelling new types of transport: one-way car sharing
Peter Davidson, Director, Peter Davidson Consultancy

Hybrid agent-based modelling of on-demand shared mobility
Mike Oliver, Technical Director, PTV Group

Modelling CAVs using a traditional highway model
Marcus Chick, Principal Transport Modeller, Highways England

Sponsored by: CATAPULT Connected Places

Chairman's Lounge

HANDLING UNCERTAINTY IN DECISION-MAKING

Chair: Luis Willumsen, Director, Kineo Mobility Analytics

Developing a scenario planning tool
Boris Johansson, Project Director, Systra, and Stephen Cragg, Associate Transport Modeller, Transport Scotland

Responding effectively to change
Annette Smith, Project Principal, Mott MacDonald

Modelling and appraisal of Northern Powerhouse Rail – from railway lines to a transformed economic geography
Jack Snape, Principal Data Analytics and Modelling Officer, Transport for the North, and Musa Imran, Assistant Economist, Northern Powerhouse Rail, DfT

A toolkit for extracting and analysing travel data using smartphone sensors
Sonal Ahuja, Director, Sunovatech

Sponsored by: Mott MacDonald

16.00 **Afternoon break:** Tea & coffee served in the main exhibition hall area

16.30

West Suite

CLOSING PLENARY

Modelling and forecasting – delivering value to the decision-maker

Chair: Tom Worsley, Visiting Professor, Institute for Transport Studies, University of Leeds

Call yourself a forecaster?
Tom van Vuren, Divisional Director, Mott MacDonald

Going beyond the BCR
Jamie King, Benefits Management Lead for the Regional Investment Programme, Highways England

Estimating the benefits of transport investment
Dr Lars Nesheim, Centre for Microdata Methods and Practice, Institute for Fiscal Studies

How can modellers add more value?
Claire Cheriyan, Strategic Analysis Manager, Transport for London

17.45 Conference close

17.50 Room with a view

MASTERS OF MODELLING AWARDS

Networking drinks sponsored by: SYSTRA

19.00 Event close

SPEAKERS A-Z

SONAL AHUJA
Executive Director
Sunovatech

DUNCAN ARMSTRONG
Managing Director
Kestrel Cam

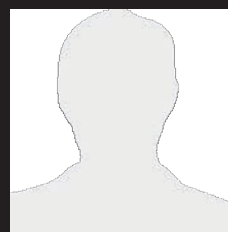
RICHARD BRADLEY
Head of Data, Modelling & Appraisal
Transport for the North

ROBIN CAMBERY
Chief Transport Modeller and Head of Modelling and Appraisal Methods
Department for Transport

DAVE CARTER
Transport Modelling Market Director
SYSTRA

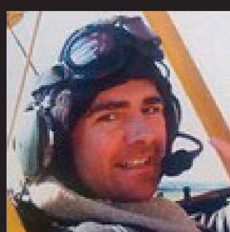
DR SAM CHAPMAN
Chief Innovation Officer, Co-Founder and Director
The Floow

CLAIRE CHERIYAN
Strategic Analysis
Transport for London

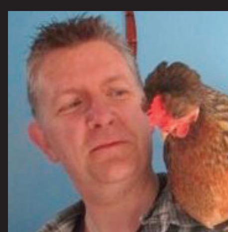


MARCUS CHICK
Principal Transport Modeller
Highways England

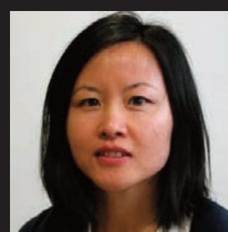
CHARISMA CHOUDHURY
Associate Professor, Institute for Transport Studies & School of Civil Engineering
University of Leeds



GAVIN COUPE
Managing Consultant
Atkins

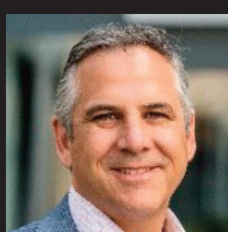


STEPHEN CRAGG
Associate Transport Modeller
Transport Scotland



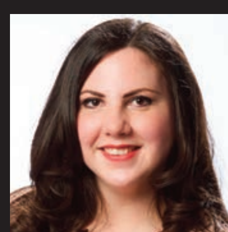
WEI CUI
Principal Technical Management and Assurance Officer
Transport for the North

PETER DAVIDSON
Director
Peter Davidson Consultancy



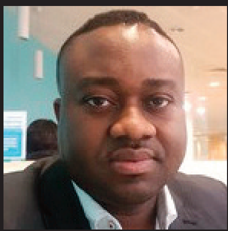
JAMES DE ROO
Director, UK Logistics
PTV Group

MARK ENZER
Chief Technical Officer
Mott MacDonald



DR PATRIZIA FRANCO
Senior Technologist in Transport Modelling
Connected Places Catapult

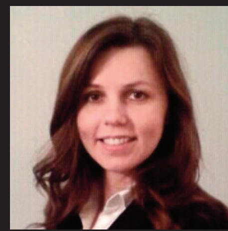
SPEAKERS A-Z



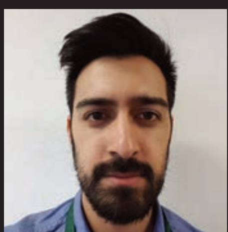
JUDE FREEMAN
Director
Vectio UK

SØREN FROST
Traffic Modelling and Simulation Specialist
COWI

TIM GENT
Technical Director, Transportation
Atkins UK & Europe



ELENA GOLOVENKO
Technical Director, Transport Modelling
Jacobs

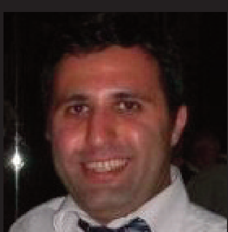


MUSA IMRAN
Assistant Economist, Northern Powerhouse Rail
Department for Transport

PHIL JAMES
Director National Urban Observatory Facility
Newcastle University

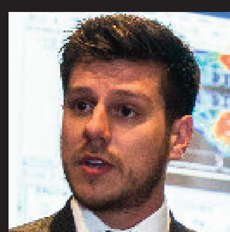
BORIS JOHANSSON
Project Director
Systra

DEVRIM KARA
Director
PTV Group UK & Ireland



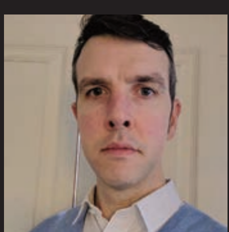
SIAMAK KHORGAMI
Regional Director, Consulting, Transportation, EMEA
AECOM

JAMIE KING
Benefits Management Lead for the Regional Investment Programme
Highways England



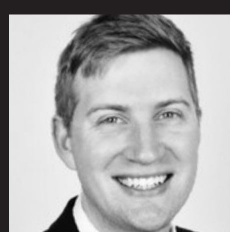
EDUARDO LAZZAROTTO
Senior Business Development Manager, Design Engineering
Bentley Systems

ADIL MOHAMMAD
Traffic and Pedestrian Modelling Consultant



LLEWELYN MORGAN
Head of Innovation
Oxfordshire County Council

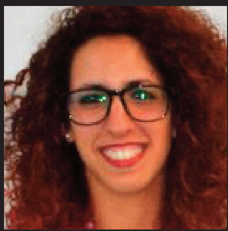
DR LARS NESHEIM
Co-Director, Centre for Microdata Methods and Practice, Institute for Fiscal Studies
University College London



MICHAEL OLIVER
Technical Director
PTV Group

PAUL O'NEILL
Director
Intelligent Data

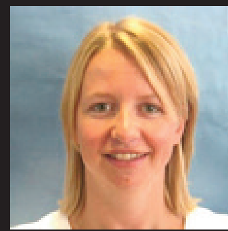
SPEAKERS A-Z



VITTORIA PARISI
Senior Applications Engineer
Immense Simulations

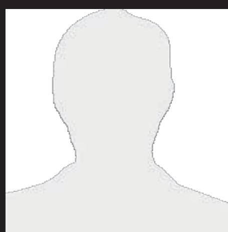
NILA SARI
Principal Transport Modeller
Department for Transport

ARUNA SIVAKUMAR
Executive Director, Urban Systems Lab & Senior Lecturer, Centre for Transport Studies
Imperial College London



ANNETTE SMITH
Project Principal
Mott MacDonald

JACK SNAPE
Principal Data Analytics and Modelling Officer
Transport for the North

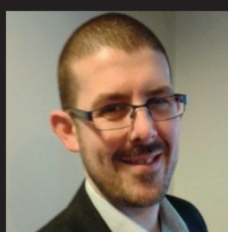


COLLINS TEYE
Strategic Transport Modeller
Transport for London

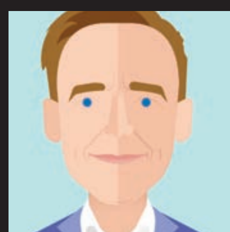
REZA TOLOUEI
Associate Director
AECOM

TOM VAN VUREN
Divisional Director
Mott MacDonald

TIM VEITCH
CEO
Veitch Lister Consulting



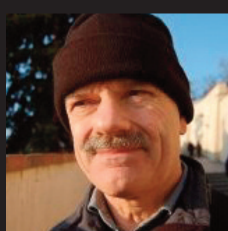
MIKE WATERS
Director of Policy, Strategy and Innovation
Transport for West Midlands



STEFAN WEBB
Director of Digitising Planning and Standards
Connected Places Catapult

DAVE WILLIAMS
Solutions Director
Immense Simulations

LUIS WILLUMSEN
Director
Kineo Mobility Analytics



TOM WORSLEY
Visiting Professor, Institute for Transport Studies
University of Leeds

CHRIS WRIGHT
Senior Consultant
MDS Transmodal

EXHIBITION FLOORPLAN

A1	A2	A3	A4	A5
highways england	TRANSPORT FOR THE NORTH	Department for Transport	intelligentdata	intelligentdata
A6	**A7**	**A8**	**B2**	**B3**
CATAPULT Connected Places	CATAPULT Connected Places	vectio	jct training software consultancy consultancy limited	aimsun.
B5	**B6**	**C1**	**C2**	**C3**
	NDC NATIONWIDE DATA COLLECTION	Basemap Digital mapping and transport data solutions	MHCtraffic	CITILABS
C4	**C5**	**C6**	**D1**	**D2**
CITY SCIENCE endless possibilities	TMPlans	INRO		
D3	**D4**	**D5**	**E1**	**E2**
	MOTT MACDONALD	Peter Davidson Consultancy Ltd		
E3	**E4**	**F1**	**F3**	
SYSTRA	SYSTRA	PTV GROUP the mind of movement	PTV GROUP the mind of movement	

Modelling World student ambassadors supported by: **JACOBS**

IT'S ALL ABOUT THE DATA...

New technologies are supporting the use of non-traditional data collection techniques, and can help to boost efficient analysis. By Jude Freeman

Traffic data is the bread and butter of the modelling and transport planning community. Data reliability, along with accuracy and timeliness in receiving information from field surveys, are crucial in ensuring that models remain trustworthy, fit for purpose and realistic.

Conventionally, data is collected over a period of time and analysed over a particular sampling period. Such data may carry a level of sampling error prior to model development and eventually be misrepresented in the final model. Subsequently, count data is also used for model calibration and validation; demonstrating its robustness to end-users and transport authorities. The more time elapses, and as data is processed, the less accurate it becomes. Human error during on-site measurements and counting – especially for manual count surveys – multiplies these inaccuracies.

In line with the Department for Transport's Transport Analysis Guidance (TAG), advice regarding data accuracy criteria states that, based on a 95% confidence interval, allowable errors should fall within ±5% for two-weeks Automatic Traffic Counts (ATCs), and ±10% to ±28% for one-day Manual Classified Counts (MCCs) – based on data samples using pneumatic tubes (for ATCs) and manual or video/ANPR surveys (for MCCs).

> Make no mistake, predictive analytics may replace modelling if we are not adaptive and open to new methods of traffic data collection for predictions concerning our transport networks

The question is, however, what if data is required for less than two weeks for ATCs, and less than one day for MCCs? In developing more interactive, intelligent and adaptive models, a transport planner or modeller must be able to obtain accurate data for shorter time periods, for immediate use for model modifications or for quick updates, if needed. It is for this reason that Vectio have adopted innovative ways of collecting traffic data.

Data collection needs to be undertaken in an accurate and efficient manner, and analysis should be delivered quickly. There should be greater involvement of modellers during the fieldwork / data collection activity. Unusually, Vectio deploys its own equipment for all surveys for use in our consultancy commissions, and applies its understanding of transport planning in both its collection of data and delivery thorough analysis and reports.

Predictive analytics vs transport modelling

Efficiency in the collection and analyses of traffic data has become more important for modellers as time passes. For transport planners and the modelling profession to remain relevant and competitive, they must counteract attempts by non-transport planning professionals – who may not naturally be modellers – to disrupt the modelling world by using predictive analytics to deliver so-called transport models.

Make no mistake, predictive analytics may replace modelling if we are not adaptive and open to new methods of traffic data collection for predictions concerning our transport networks. Data-mining, modelling, machine learning and artificial intelligence are already being used to analyse current / live data to make rapid predictions about the immediate future.

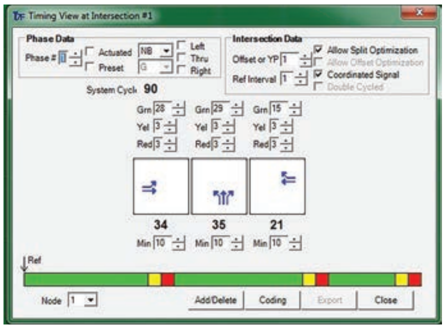
Predictive analytics professionals, within and alongside powerful companies such as Google, are currently and continuously planning ways to provide free 'predictions' about traffic, pedestrians, consumer behaviour and the general movement of people using transport networks.

Precision from the air

The investment in new technologies is one of the fundamental pillars of our company. Our ultimate goal is to obtain reliable and accurate results, and the acquisition of cutting-edge technology is essential. We deploy drones for taking high quality aerial photographs and videos, and combine these with our Origin-Destination Software (OD Soft), which has GPS and GLONASS technology, enabling constant monitoring through a mobile application. We create seamless information flow and data calculations in real-time, generating precise data counts within a network, for example a complex roundabout or intersection.

Drone flight

Radar equipment



Artificial vision technology: fast creation of turning counts / OD matrices

A good analysis of mobility issues can only be achieved with high quality, accurate and reliable data. Vectio utilises artificial vision equipment for the automatic measurement of directional traffic, both for vehicles on road sections and at junctions, and for pedestrians. This type of camera is considered to be top quality in terms of data collection and processing technology.

The combination of OD Record – a mobile device that can be controlled and configured in several time intervals, in situ or programmed through an exclusive recording software – and OD Soft – analysis software using video image files, enables the processing and recording of the number, position and category of each vehicle, as well as the speed and direction each one takes, generating accurate OD matrices.

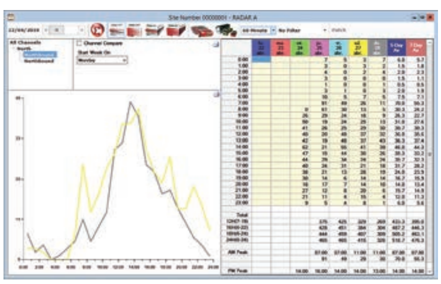
Radar equipment for ATC: surveys at inaccessible locations

Vectio has employed the use of radar technology to acquire vehicle data in a non-intrusive way, without stopping traffic or the need for traffic management (in most cases). The operator can install the equipment without being exposed to unnecessary danger. The radar gauge uses algorithms to calculate vehicle speed and length information with high precision.

In terms of its accuracy, tests (as well as Vectio's experience) shows that on two-way roads of high density (more than 12,000 vehicles / day), the captured data has an accuracy of 98 % in the nearest lane, and 96 % in the farthest lane. The speed of the vehicles can also be recorded with an accuracy of +/- 1 mph. Importantly, the radar can be used in cases where live traffic data feeds in real-time is required. A transport modeller can therefore analyse and incorporate data directly into a model whilst the data collection equipment is still on site and counting data.

At Vectio, after more than 500 successfully completed projects, what sets us apart from our competitors is our use of the best technology for collecting and analysing traffic and mobility data; and in utilising such data to provide robust technical advisory and design services.Two concepts that historically have been handled separately – traffic engineering and transport planning – come together at Vectio. Being a transportation planning consultancy that also handles data collection, measurement, modelling and analysis, we have control throughout the process. We can provide real-time 24/7/365 services and offer diagnostics with online visualisation / monitoring for clients. ■

Artificial Vision technology



Jude Freeman is Director at Vectio UK
www.vectio.com

THE GRAND CHALLENGE: MAKING THE CASE FOR INVESTMENT

In Transport for the North's Strategic Transport Plan and Investment Programme, you'll see references to work being evidence-led. Jack Snape talks about why that evidence is so important, and how TfN is predicting the impact that investing in transport will have on the North's communities

When I tell people I work at Transport for the North (TfN), and that our ambition is to use transport to connect the towns and cities of the North into a more productive economic area, I am often immediately asked why this hasn't been done sooner. To most people, this sounds like a great idea, so what has stopped us in the past? Perhaps unexpectedly, I think the main reason for this is modelling and appraisal.

The first key issue for new transport schemes in the North of England is that they can be relatively expensive, sometimes requiring tunnelling through hills or sensitive engineering through national parks. The second is that the methods traditionally used to model and appraise schemes often don't show the level of economic and societal benefits required to offset these costs.

This is partly because these methods are based on current and historical travel patterns, and in cases where geography and a poor connectivity have held back travel for decades, these tools often just forecast a slight increase in travel between neighbouring cities. There's also the issue of current low levels of economic productivity in the North, which typically leads to lower estimates of economic benefits. In other words, if you're less productive to start with, economic models suggest the productivity boost you get from better transport will be smaller. The problem is that we are trying to increase productivity through transport investment, but the low productivity hinders our ability to make the case for investment. This is how modelling and appraisal has trapped the North in a vicious cycle of low investment and low productivity.

The Government has previously said that it wants to sort this out, by re-balancing the economy away from London and the South East to other parts of the country, including the North. This objective is based on the idea that the UK's productivity challenge is largely a result of these areas significantly lagging behind the capital, and that a turnaround in the UK's fortunes overall can only be achieved by correcting the imbalance and boosting productivity in these slower growing regions. Key policies available to do this include skills, local industrial strategy and transport investment. TfN's role is to make the case for transformational transport investment that would enable the North to function as a single economic area, with productivity growth driven by easier commuting, trade and knowledge-sharing, both within and between our city regions. By pooling the economies of the North's major towns and cities, job markets and trade networks should be expanded to a level that could begin to compete with London.

> "I wanted a better quality of life – more space, access to national parks and a lower cost of living. If we can develop modelling and appraisal tools that allow us to value these things, alongside the more concrete measures of productivity, then that will be a big step forward

This sounds great, but it's a bit tricky to represent in a model.

In TfN's Transport Appraisal Modelling and Economics (TAME) team, we are focused on developing new modelling and appraisal approaches and tools to show how this economic transformation could happen. We have new tools, like our Northern Economy and Land-Use Model (NELUM), that don't rely on trend-based analysis and can represent more dynamic, structural changes in the economy as a result of transport investment. Our tools are striving to capture a more comprehensive and rounded picture of economic benefits, looking beyond time savings and productivity to estimate improvements in welfare and well-being for different socio-economic groups. We're also trying to develop more mission-oriented appraisal frameworks centered around the grand challenge of re-balancing, rather than appraising incremental improvements in isolation.

We need to ensure that these new tools are rigorously evidence-based, so that the Government can be confident in using their outputs to inform spending decisions. We also need to keep working closely with the Department for Transport (DfT) on how we can develop cutting-edge, innovative approaches that become accepted as best-practice.

A key opportunity to shape this thinking came last year, when DfT launched a consultation exercise to gather views on the scope and priorities for a new Appraisal and Modelling Strategy to help ensure that their guidance, WebTAG, remains best practice and addresses the likely future challenges facing practitioners and decision-makers conducting transport appraisal.

The Strategy aims to provide robust, flexible and easy to use modelling and appraisal tools that can be used to inform the critical policy decisions that will be made over the next five years. The DfT consultation set out their initial views within five key themes and provides initial views on priorities:

- People and place
- Reflecting uncertainty over the future of travel
- Modelling and appraising transformational investments and housing
- Supporting the application of WebTAG and making it more user friendly
- Developing and maintaining modelling and appraisal tools to meet user needs

We worked with practitioners in partner organisations to coordinate a Northern-level response to the consultation. Our response welcomed the draft Strategy as a further step towards an appraisal system that can better represent transformational investment and wider economic impacts. The final Strategy has now been published and important steps have been made towards a more rounded approach to appraisal, although there remain areas for improvement where we can work the DfT to ensure the system is no longer skewed against investment in Northern transport schemes. Key areas we have highlighted for improvement include:

- recognition that current approaches do not adequately address the objective of re-balancing the economy;
- more accurate representation of the local traveller experience, to ensure a fair framework for investment;

Methods traditionally used to model and appraise schemes often don't show the level of economic and societal benefits required to offset costs as they are based on current and historical travel patterns

- more work to integrate analysis across different modes of transport and long-term programmes of schemes;
- a greater focus on employment and skills; and
- continuation of efforts to realise a holistic view that recognises the interaction of transport with other sectors, including links to local growth, public health, energy, digital and housing.

Our response also covers some of the technical challenges faced by TfN and our partners in developing complex modelling and appraisal systems, and some suggestions on things the DfT could do to help, such as making key datasets more readily available. You can read more about this in a report on 'Modelling and Appraisal Challenges', published recently by Richard Bradley, our Head of Data, Modelling and Appraisal, available on the TfN website.

Putting the technical arguments to one side, what I really want from our models is a decent representation of what we experience in real life. When I moved back to the North from London a few years ago, I didn't particularly care that I was moving to a less economically productive area, I wanted a better quality of life – more space, access to national parks and a lower cost of living. If we can develop modelling and appraisal tools that allow us to value these things, alongside the more concrete measures of productivity, then that will be a big step forward. ■

Jack Snape is Principal Data Analytics and Modelling Officer, Transport for the North **www.transportforthenorth.com**

THE FUTURE OF TRANSPORT DATA COLLECTION

The transport data collection industry is changing. The needs of modellers and planners have evolved, and technology advances have accelerated rapidly, changing the way we collect, store and use data, says Nick Mather

There is a sense of a new direction for modellers and planners in using larger, richer data sets in a more efficient way, increasing the usefulness of data and addressing the notion of DRIP (Data Rich, Information Poor, a term taken from a report by Vik Bhide, Smart Mobility Manager, City of Tampa, USA). The focus is on being able to handle lots of data sources at the same time, to look at the data as a whole across potential multiple users that may have different requirements, and ultimately extract more valuable insight from the data sets. Essentially, users of these data sets are more able to tease out useful data and to tell a better 'story' using the data.

Over the last few years, examples of advances in technology for data collection include:

- **Mobile phone network data (MND)** has now become a mainstream data source and has largely replaced the need for large-scale roadside interview census surveys (although there is still a need for a small number per project to validate the MND-derived origin-destination movements)
- **Vehicle GPS data** harvested from fleet trackers and live SatNav devices (in-built and free-standing units) has reduced the need to undertake vehicle route journey time surveys
- **Public transport ticketing systems** such as Oyster have reduced the need for public transport user interview surveys
- **Database systems** have gradually been adopted by public sector bodies to store and re-use survey data, reducing the unnecessary collection of fresh data where some exists already
- **Implementation of permanent data capture infrastructure:** Highways England and other highway authorities have introduced smart motorways, permanent ANPR cameras, radar sensors and average speed cameras, reducing the need for data collection on some parts of the road network

There is very strong research and development evidence (as well as real world examples), that further advances in technology and the accessibility of public or big data sources will continue to change the landscape for traditional traffic surveys and data collection. Such emerging and known technologies include, but are not limited to:

- **Connected Autonomous Vehicles/connected & intelligent infrastructure:** there will be a mass of telematics data flowing between vehicles and the infrastructure controlling traffic and movement as these technologies continue to be developed and integrated into the vehicle fleet
- **Increasing granularity and accessibility of big data sources** including from 5G+ mobile network data (MND), which will improve the granularity of these datasets, public transport ticketing systems, public transport automated patronage counting systems (APC) expanding into buses and trams, and Mobility as a Service (MaaS) platforms generating end-to-end journey data
- **AI sensor networks** linked to traffic control and information systems; primarily utilised to create smarter cities but generating a side-product of data

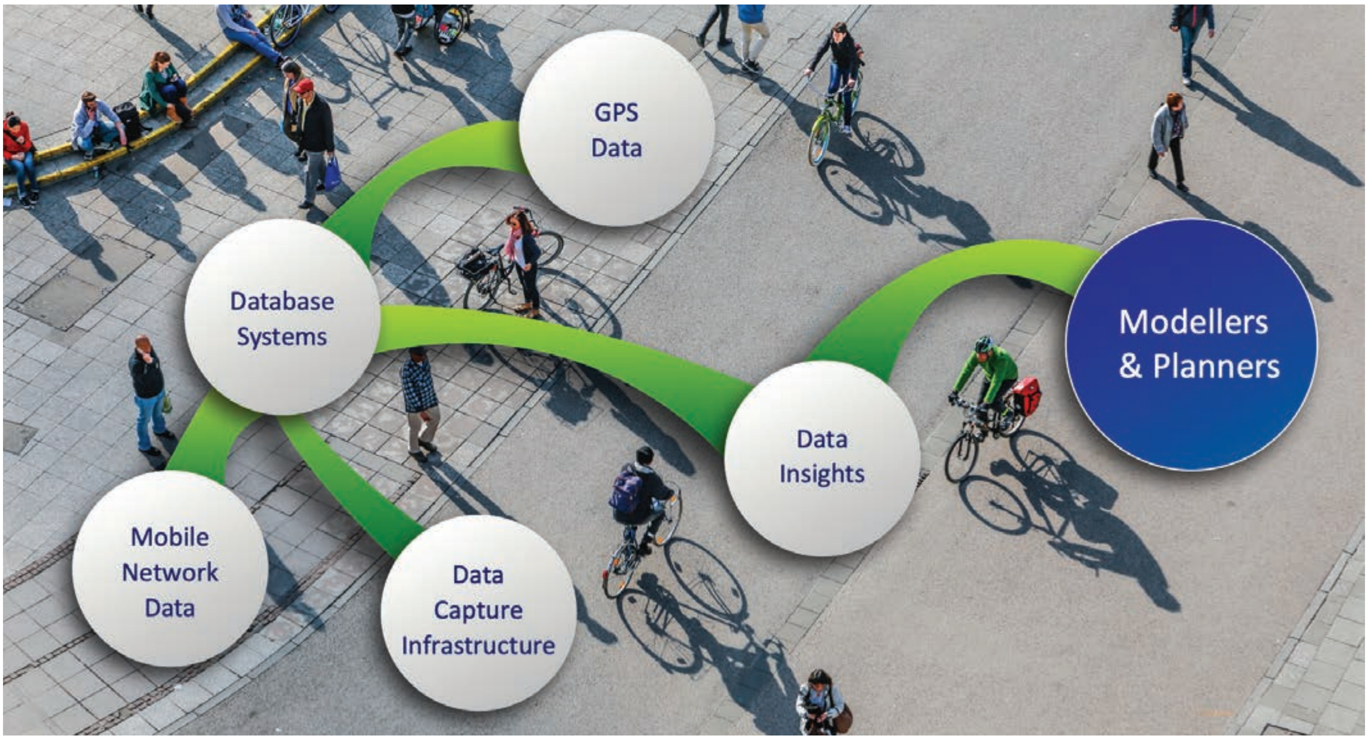
New technologies can increase the usefulness of transport data

The gradual shift

Whilst there will always be a need to undertake ad-hoc and temporary installation of traffic counting equipment, the shift in future will be towards accessing existing datasets that require no new physical infrastructure, yet can provide greater insight for planners and modellers. By the very nature of this shift in data sources, end users will be able to benefit much more from the data itself, in terms of harvesting, aggregating and visualising this data, and ultimately interpreting it and telling the story.

Real time data

Again, whilst there is still value in an ad-hoc data set that gives an insight to a very limited snapshot in time, the requirement for real time data is ever increasing. Real time data allows modellers and planners to be much more agile in their approach to each task. The progression from long time interval data to regularly updated data means that reaction can be quicker and based on a cleaner and more thorough data set. Change can be implemented in good time, mitigating any negative impacts that may have occurred with a longer time lag between periodic data sources.



New datasets can provide greater insight for planners and modellers

Data reporting

Going are the individual reports supplied in .csv format that offered very little insight and were hard to easily cross-reference with existing data. In future, data will be supplied through online dashboards which develop over time and enable the data user to manipulate and visualise the data with the click of a button. Not only that, the possibility of creating platforms that can accept APIs from any piece of existing equipment or data source, and present the data in a single, accessible place for an entire transport team, highlight the value of such reporting tools. This way of using data is far more secure than a 'traditional' method, which suits the current regulatory environment.

GDPR compliance

Given the recent update in data protection laws, clearly data governance and data privacy are big issues, particularly if data is sensitive or personal. Traditional data collection methods such as data capture using temporary camera systems and post fieldwork analysis create many potential issues regarding personal and sensitive data. This is due to the collection of a mass of high quality footage in which the features of individuals could be identified, therefore appropriate transfer, storage, retention and systematic deletion processes are required, which increases risk. Newer and emerging methods lend themselves to a more robust and secure process.

Integrated AI sensors collect vehicular and active travel modes, transmitting the count data only, therefore being inherently more compliant and require no intermediate physical transfer of raw information. Data can be delivered in a more secure way, such as through a cloud-based system in a compliant IT environment. The accessing of data can be controlled using firewalls, passwords and partitions, with different users authorised for different levels of access.

We are most certainly at a point in time where these new sources of data and better data reporting capabilities are enabling smarter insights from data, and so providing tangible benefits for transport professionals. From saving time and cost and generating increased efficiencies, to gathering and reporting on a richer data set, it is an exciting time for the industry. Any opportunity that technology can offer in terms of enhanced insight into the data we collect should be embraced, and the reliance on temporary survey data reduced. ■

> “The shift will be towards accessing existing datasets that require no new physical infrastructure

Nick Mather is Business Development Director for Tracsis
www.tracsistraffic.com

UNDERSTANDING ICT NETWORKS AND DATA FOR ACCESSIBILITY ANALYSIS

What are the implications of the spatial and temporal variation of ICT services for transport modelling and transport planning? By Hannah Budnitz

The understanding of how transport networks operate, how supply and demand interact, and how transport data is produced provides important context for transport practitioners who are tasked with measuring and modelling mobility and accessibility. But whilst the study of mobility tends to focus on distance and speed of travel, accessibility is more concerned with the opportunities available to participate in activities, obtain goods, and benefit from services, along with the spatial and temporal barriers to doing so. Within the framework of accessibility, therefore, both transport infrastructure / services and Information and Communication Technologies (ICT) are means to enable opportunities or to overcome constraints, rather than ends in and of themselves.

ICT data has been used to inform transport models in recent years, but there is less consideration of the potential to incorporate ICT itself as an access mode, even though the ongoing digital revolution has resulted in transport and online access becoming ever more interchangeable, flexible, and seamless. Yet before transport practitioners can incorporate ICT data into more comprehensive models of accessibility, never mind the subsequent business cases, development assessments and monitoring regimes, they must fill their gaps in understanding how ICT networks operate, how ICT supply and demand interact, and how ICT data is produced. This article aims to explore some of the implications of transport planners and modellers using ICT data to explore not only transport use, but also internet activity and its interaction with transport demand.

ICT networks: supply and demand

The capacity and operation of ICT infrastructure may be managed by different companies, monitored by separate organisations, and overseen by different Government departments than transport, yet that does not mean that ICT actors operate in completely different ways. There are also a multitude of actors involved in providing, managing, regulating, and monitoring different transport modes and services, but transport practitioners still see themselves as part of a single sector and could extend the same courtesy to ICT colleagues. The issue is one of perception. Whilst transport is viewed as a geographical discipline of overlapping networks, it is tempting to think of the 'Internet' or 'cyberspace' as a singular entity, equally accessible from anywhere with a connection. Like transport, however, ICT networks have a geography and a geometry, varying levels of service, and varying levels of demand. They provide a different experience depending upon access location, access method, time of use, and type of use.

Although the routing of information along the network is changing constantly and does not have the same direct, physical relationship to distance as does transport infrastructure, distance does still affect digital capacity and accessibility. The highest speeds are mainly available in urban areas, which have a greater density of infrastructure and larger residential markets for internet service providers to target. However, there are exceptions, as some rural areas have benefitted from increased investment or local, innovative operators. Figure 2 shows the median broadband download speed for working days by neighbourhood (Middle Layer Super Output Area) as summarised from millions of individual home speed-checks performed on www.broadbandspeedchecker.co.uk between 2012 and 2016. With appropriate data, similar maps could be made to reflect the coverage and quality of mobile internet services and which 'generation' of service can be accessed.

The uneven distribution of Internet accessibility is not just geographical, but is also affected by socio-demographics. Just as people suffer transport poverty, so too they can suffer ICT poverty. For example, Internet use in the UK is high,

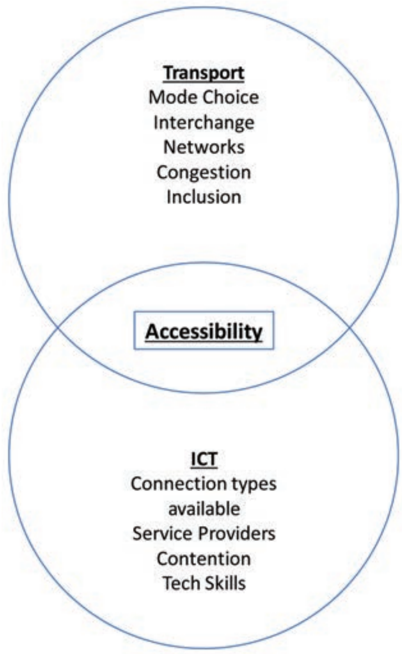


Figure 1

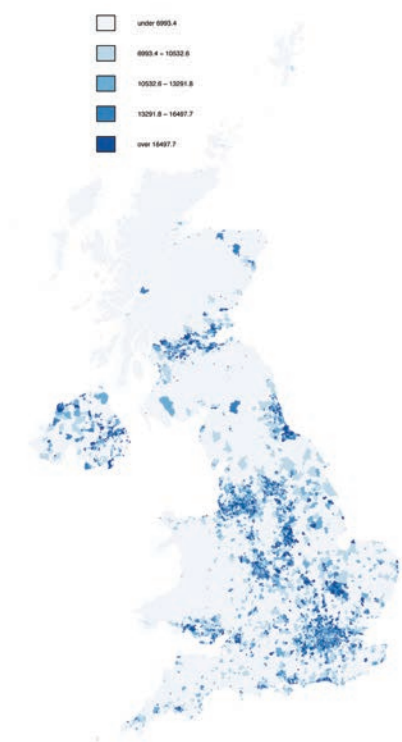


Figure 2: median broadband download speed for working days

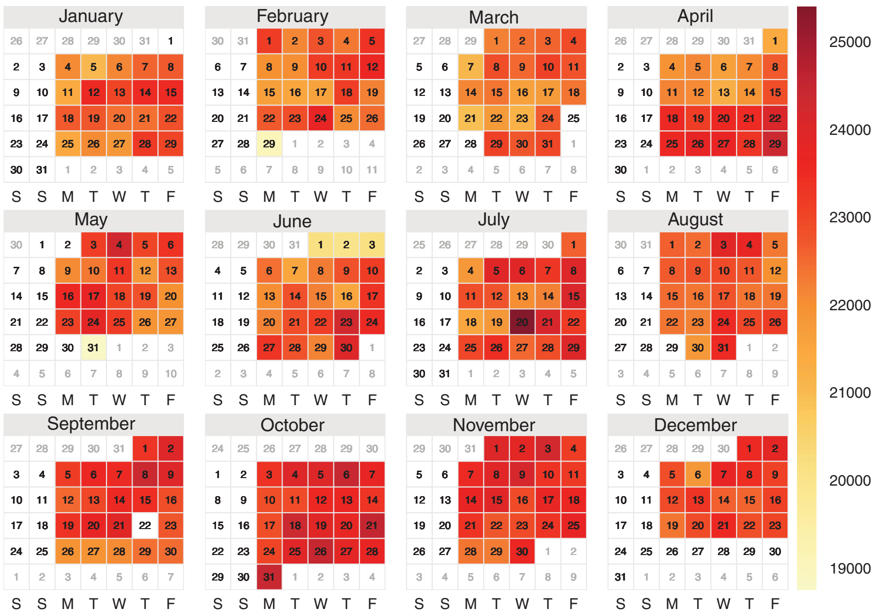


Figure 3: speeds vary during the working day and between days

> If we as transport practitioners are to be able to measure and model the future of access, inclusion, sustainability, and resilience, we have to view ICT as an integral and integrated accessibility option with its own network characteristics

but has been shown to drop off among individuals over 50 years old, and only a fraction of those over 75 are online. Just as transport accessibility is a function not only of distance, but also of time and cost or the convenience and effort required to make a trip, so ICT accessibility requires inputs of time and effort to find information or make a transaction, affecting the attractiveness of the access available and the level, fixedness or flexibility of demand.

Excess demand at peak hours on transport networks result in well-studied phenomena such as congestion and over-crowding, particularly in the highly concentrated, weekday morning peak. Yet congestion, or as OfCom terms it, 'contention', occurs on ICT infrastructure too. The more people engage in downloading high volumes of data, the lower 'bandwidth' available and the slower the speeds on the wider network. Peak hours are in the evening, after work, when more people are using their internet connection for leisure purposes, such as streaming audio or video content, but speeds also vary during the working day and between days as shown in Figure 3 (above).

So what are the implications of the spatial and temporal variation of ICT services for transport modelling and transport planning? Mobile network data is sometimes seen as a potential replacement for traffic counts and roadside interviews. However, without an understanding of spatial, temporal, and demographic coverage, sampling biases could be overlooked or certain areas could produce much larger or smaller samples than was expected. ICT data, sometimes even from transport-related functions such as navigation, ticketing, or sensors on transport infrastructure, is also seen as a window into how travel behaviour is becoming more variable and flexible. Yet, the ICT data may have different spatial and temporal variation than the travel behaviour variation it is trying to measure.

In conclusion, as the use of the Internet as an alternative means of access for ever more activities continues to grow, travel behaviour is becoming more flexible. Not only teleworking, but online services from banking to health, online shopping, and social media are all replacing trips, potentially freeing time for other purposes including new types of travel. Internet access is also available on transport, generating access multi-tasking behaviours. Thus, if we as transport practitioners are to be able to measure and model the future of access, inclusion, sustainability, and resilience, we have to view ICT as an integral and integrated accessibility option with its own network characteristics. We need insights into its operation and use, of which this paper hopefully provides a few. ■

Hannah Budnitz is a Doctoral Researcher at the University of Birmingham **www.go-how.com/blog/**

IMPROVING MODELS WITH LOCATION-BASED DATA

Citilabs' Streetlytics uses a proprietary optimisation process to accurately weigh and adjust location data. Oliver Charlesworth explains how its data sources provide modellers with several ways to improve traffic forecasting accuracy

Many companies sell location data collected from smart phones, in-vehicle probes and similar devices. Location data can tell you where sampled people are coming from and going to, when they are travelling, and where they live and work.

But, by itself, location data cannot answer the questions of 'how many?' and 'how did they get there?' Location data is collected from a segment of the overall population including app users, owners of a certain brand of car, or subscribers to a specific cell phone carrier, and typically does not have enough location points to determine an accurate route and mode of travel.

For many industries and applications, questions such as 'how many people see my message on an average day?', 'how many people travel from one area to another area?', and 'how many vehicles will be on this segment of road at 5pm?' are very important ones. Without a rich understanding of the movement of people, these questions cannot be accurately answered.

Using optimisation

In a simple weighting process, one takes location data collected from users of a mobile app, determines where those users live, and then estimates a weight based on the number of app users compared to the population of the area. This equates to proportionally scaling the sample to the full population, based solely on the penetration rate of the apps used in the area.

> "The weighted and corrected location data provides one view, the logical view provides a second, and the traffic counts provide a third

While that may sound adequate, it alone is not very accurate. Frequently, when comparing the scaled results against independent data sources such as traffic counts and data quantifying the number of people that live and work in a location, the results obtained through simple weighting are clearly not accurate.

Citilabs' Streetlytics uses a proprietary optimisation process to accurately weigh and adjust location data. This process includes:

- Creating the location data view by scaling the source location data using a traditional survey weighting process. This provides the scaled estimate of total population movement based on the source location data.
- Building a logical view of the probable movement of total population using modelling techniques that we have developed over the last 30 years, and apply predictive modelling algorithms that are developed through the analysis of robust national and regional government travel surveys into accurate, up-to-date household and employment data. These algorithms calculate 'how many' trips are likely to travel from neighbourhood to neighbourhood, what time of day those trips are likely to occur, and what mode of travel is likely being used based on behaviour captured in the travel surveys.
- Collecting all the traffic counts available in each area. While these counts may not be perfect (they are samples), and are weighted and collected using a variety of techniques, they do provide another independent view of 'how many' people and vehicles are travelling on a region's roads. Knowing how many vehicles each road has historically served ensures that Streetlytics explicitly reflects local traffic dynamics.
- Applying an optimisation process that integrates each of these different 'views' of population movement. The weighted and corrected location data provides one view, the logical view provides a second, and the traffic counts provide a third. This process takes the best of each data source maintaining the important spatial and

Above: location data is collected from smart phones, in-vehicle probes and similar devices

Right: Streetlytics provides Origin-Destination matrices, traffic volumes, and speeds for different seasons, days of the week and periods of the day

temporal patterns provided by the population, and employment data provide by the logical view, while constraining the calculated movements to the measured ground truth.

Model validation

Models are applied to base year inputs to calculate base year model estimated origin-destination (OD) matrices of movement, and traffic assignments of volumes, speed and congestion. The model results are then compared and adjusted to match independent observations in a process known as model validation. Streetlytics provides rich sources of data for model validation:

- Origin-destination vehicular trip matrices by trip purpose, by season, by day of week, and period of the day
- Highly accurate measurements of traffic volumes at all locations on the road network by season, by day of the week, and hour of the day
- Measured travel speeds on all roadways by day of the week and hour of the day

External original-destination matrices

One of the classic weaknesses of any model is its ability to estimate travel that passes through the model region or has one end of the trip outside of the model region. Streetlytics provides external origin-destination matrices.

Improved time of day, weekend and seasonal modelling

For those regions with models that incorporate time of day, weekends, and seasons in their models, Streetlytics contains rich observed data:

- Observed OD patterns by season, period of the day, and day of the week, including weekends
- Measured traffic volumes on all road segments by season, by hour of the day, day of the week and season

Spatially accurate networks and future proof zone systems

Streetlytics data is provided on up-to-date spatially accurate road networks and at the United States Census block group zone level. Spatially accurate networks not only provide a much better visual appearance for results, they also are much more accurate both in their distances and travel times, as well as in the road attributes such as the number of lanes versus typical historic ‘stick’ networks.

Better forecasts through incremental model application

Traffic forecasting models are designed for the purpose of forecasting traffic flows, ridership, revenues, congestion levels and environmental impacts associated with infrastructure, operation and policy changes. In order to prove their validity, modellers in many locations apply these models to see how well they can model today. In the process of doing so, many forecasting models are adjusted so much so that their sensitivities to forecasting change are skewed inappropriately.

Streetlytics offers an opportunity to avoid this pitfall by applying forecasting models to estimate change, and then applying that change on Streetlytics’ highly detailed observed OD flows and volume observations. That process, used in many places around the world today, is known as incremental modelling. Not only does this approach allow observed origin-destination matrices to be developed for forecasting, but this approach also enables models to always be up to date. No longer does a model have a ‘base year’—it is simply a forecasting model applied to current year Streetlytics data.

While Streetlytics is currently only offered in the US, there are many opportunities to bring the benefits and enhanced traffic and population movement analytics to communities across Europe. Citilabs will be looking to partner with data-rich organisations to bring our tested methodologies and services to European cities and communities. ■

Oliver Charlesworth is a Global Accounts Director at Citilabs
www.citilabs.com

3D VISUALISATION AND MIXED REALITY MODELS

Simulation solutions provide 3D visualisation, plus mixed and augmented reality, to show the impact of transportation links on their surrounding environment. By Sonal Ahuja

3D infrastructure visualisations provide city planners with a unique insight into the impact of new infrastructures on their surrounding environment, even before the project has been implemented

As a result of changing economic and political synergies across the globe, decisions regarding infrastructure investment have become increasingly challenging for city leaders. For such decisions and investments to be made with confidence, certain projection and analytical tools are required.

Such tools can help city planners to anticipate human reactions to infrastructure that has not yet been built, effectively manage and plan measures for resolving traffic congestion, make plans for new infrastructure and transit links that are both safe and environmentally-friendly, and justify investments and their returns.

With it being difficult – if not impossible – to create a single city planning solution that fits the needs and requirements of all cities, uncertainty among city planners and lack of confidence in available solutions can slow down the decision-making process. Traffic and congestion may worsen as a result of these delays. Transportation links and their supporting infrastructures are essential components of cities. The survival of links in any given area depends on its surrounding ecosystem; for example, if there are enough people available to pay for and use the links, and if the economy is strong enough.

Visualising ideas

Simulation solutions offered by Sunovatech provide 3D visualisation, plus mixed and augmented reality, to show the impact of transportation links on their surrounding environment. Sunovatech's solutions incorporate all elements of transportation infrastructure, from road and highway operation and public transportation to ITS, as well as road safety and the environment.

Sunovatech's solutions enable city planners to effectively carry out transportation logistics, traffic engineering, urban development, urban formation, utilities management and the monitoring of driver behaviours on a 3D modelling platform.

In a fast-growing industry, Sunovatech's engineering background sets it apart from competitors. By layering mathematical analyses and visualisations of operations, projects can be 'virtually implemented' before becoming reality. 3D modelling can help to predict how successful a project is going to be in terms of ergonomics and social dynamics within an area.

Sunovatech processes accurate data from traffic and related infrastructure by using the Sunovatech virtual reality 'SVR engine', a multi-core data processing and amplifier tool that processes the outcome of engineering simulation software and simplifies vast, complex statistical information into dynamic animation key frames.

These frames are then integrated with 3D models that produce a powerful tool that visually analyses the impact of the infrastructure proposal on its surrounding operations and associated stakeholders.

The company also is also creating mixed and augmented reality simulations by connecting public

All elements of transportation infrastructure are incorporated into the solutions developed by Sunovatech

> By layering mathematical analyses and visualisations of operations, projects can be 'virtually implemented' before becoming reality

Visualisation can help to show the impact of transportation links on their environment

infrastructure management systems with virtual models of entire infrastructure networks. The platform will be capable of connecting real-time information from several stakeholders to a single unified platform that provides layers of information suited to the needs of the user. Such technology is expected to be a game-changer for city planners.

Serving city planners' needs

Human lives have changed dramatically since the introduction of smartphones. This, in turn, has led us into an era of data dependency, where priorities and lifestyles are, to some extent, based upon the artificial intelligence (AI) used by applications. In developing its mixed and augmented reality solutions, Sunovatech has focused on providing its users with a common platform on which to manage infrastructure operations.

The company's current developments are focused on creating tools that connect users to a persistent layer of reality; for example, virtually notifying a user or commuter about the occupancy levels and the route of a public transit service; or notifying a driver about road hazards well in advance, without obstructing their view of the road. The possibilities are endless and, in the future, users will be able to take full advantage of augmented layers in real-world scenarios.

Mixed reality solutions have the potential to change how people commute, work, communicate and relate to the world. With the help of Sunovatech's solutions, decision-makers will be able to assess their city's elements, thereby helping them to make swift and efficient decisions, ultimately resulting in smarter and sustainable transportation infrastructure for generations to come. ■

Sonal Ahuja is Executive Director, Sunovatech **www.sunovatech.com**


PTV GROUP
the mind of movement
You know the benefits of establishing a smart city. We know how to realise it best.
With our traffic software, we help over 2,500 cities model, simulate, plan, analyse, and predict traffic and transport to optimize the flow of movement.
Take a virtual tour of our PTV Mobility Lab at ptv.to/mobilitylab or join the conversation, #MindofMovement.
www.ptvgroup.com